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13-3247
099-00120

EVERETT ENERGY, LLC

POWDERMILL MINERAL SEPARATION FACILITY
ID NO. Pending

REG. 13 INITIAL APPLICATION

DIVISION OF AIR QUALITY

Submittal Date: April 2015

P & A Engineers and Consultants, Inc.

312 Justice Avenue
Logan, WV 25601

Phone (304) 752-8320
Fax (304) 752-7488

April 28, 2015

Mr. William F. Durham
Division of Air Quality
601 57th Street SE
Charleston, WV 25304

RE: Powdermill Coal Separation Facility
Initial Reg. 13 Application
ID# Pending

Dear Mr. Durham:

On behalf of Everett Energy, LLC, P & A Engineers and Consultants, Inc. submit the enclosed Initial Reg. 13 Application for the Powdermill Coal Separation Facility. The submittal fee and additional copies are included in the submittal.

The application addresses the construction and operation of a dry coal and mineral separation facility to be located in a remote area of the Powdermill Branch Surface Mine, in Wayne County, WV.

The legal advertisement has been placed in the Wayne County News and will be submitted upon receipt.

If additional information or clarification is needed, please contact me at the Logan address listed above or call 304-752-8320.

Sincerely,

Donna J. Toler
Air Quality Project Manager

donnatoler@suddenlink.net

TABLE OF CONTENTS

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION **DIVISION OF AIR QUALITY** 601 57th Street, SE Charleston, WV 25304 (304) 926-0475 www.dep.wv.gov/daq	***APPLICATION FOR NSR PERMIT*** ***AND*** ***TITLE V PERMIT REVISION*** ***(OPTIONAL)***
PLEASE CHECK ALL THAT APPLY TO NSR (45CSR13) (IF KNOWN): ■ **CONSTRUCTION** ☐ **MODIFICATION** ☐ **RELOCATION** ☐ **CLASS I ADMINISTRATIVE UPDATE** ☐ **TEMPORARY** ☐ **CLASS II ADMINISTRATIVE UPDATE** ☐ **AFTER-THE-FACT**	PLEASE CHECK TYPE OF **45CSR30** (TITLE V) REVISION (IF ANY): ☐ **ADMINISTRATIVE AMENDMENT** ☐ **MINOR MODIFICATION** ☐ **SIGNIFICANT MODIFICATION** IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS **ATTACHMENT S** TO THIS APPLICATION

FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

Section I. General

1. Name of applicant *(as registered with the WV Secretary of State's Office)*: **EVERETT ENERGY, LLC**	2. Federal Employer ID No. *(FEIN)*: **46-5047043**
3. Name of facility *(if different from above)*: **POWDERMILL COAL SEPERATION FACILITY**	4. The applicant is the: ☐ **OWNER** ☐ **OPERATOR** ■ **BOTH**
5A. Applicant's mailing address: **PO BOX 211** **PIKEVILLE, KY 41502**	5B. Facility's present physical address: **Powdermill Branch, Wayne County, WV**

6. **West Virginia Business Registration.** Is the applicant a resident of the State of West Virginia? ■ **YES** ☐ **NO**

- ⇨ If **YES**, provide a copy of the **Certificate of Incorporation/Organization/Limited Partnership** (one page) including any name change amendments or other Business Registration Certificate as **Attachment A.**
- ⇨ If **NO**, provide a copy of the **Certificate of Authority/Authority of L.L.C./Registration** (one page) including any name change amendments or other Business Certificate as **Attachment A.** **See Attachment A**

7. If applicant is a subsidiary corporation, please provide the name of parent corporation: N/A

8. Does the applicant own, lease, have an option to buy or otherwise have control of the *proposed site?* ■ **YES** ☐ **NO**

- ⇨ If **YES**, please explain: **Property is leased and operated by Everett Energy, LLC – copy of the lease is available in Engineering or Corporate Office**
- ⇨ If **NO**, you are not eligible for a permit for this source.

9. Type of plant or facility (stationary source) to be **constructed, modified, relocated, administratively updated** or **temporarily permitted** (e.g., coal preparation plant, primary crusher, etc.): **SCREENING – MINERAL SEPARATION SYSTEM**	10. North American Industry Classification System **(NAICS)** code for the facility: **212111**
11A. DAQ Plant ID No. (for existing facilities only): **PENDING – NEW CONSTRUCTION**	11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only): **NONE – INITIAL REGISTRATION**

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

12A.

➪ For **Modifications, Administrative Updates** or **Temporary permits** at an existing facility, please provide directions to the *present location* of the facility from the nearest state road;

➪ For **Construction** or **Relocation permits**, please provide directions to the *proposed new site location* from the nearest state road. Include a **MAP** as **Attachment B**.

I64 West to Exit 1, Take Route 52 South for 28.7 miles, turn left onto haulroad at Powdermill Branch, Take haulroad to end, approximately 1 mile, plant site at end of haulroad

12.B. New site address (if applicable):	12C. Nearest city or town: **Fort Gay**	12D. County: **Wayne**
12.E. UTM Northing (KM): **4211.79715**	12F. UTM Easting (KM): **367.03896**	12G. UTM Zone: **17**

13. Briefly describe the proposed change(s) at the facility: **Proposed construction of a screening facility with a stationary FGX Mineral Separation Unit to be used in the recovery and separation of raw coal**

14A. Provide the date of anticipated installation or change: **10-01-15** ➪ If this is an **After-The-Fact** permit application, provide the date upon which the proposed change did happen: / /	14B. Date of anticipated Start-Up if a permit is granted: **10-30-15**

14C. Provide a **Schedule** of the planned **Installation** of/**Change** to and **Start-Up** of each of the units proposed in this permit application as **Attachment C** (if more than one unit is involved). **See Attachment C**

15. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application:
Hours Per Day **24** Days Per Week **7** Weeks Per Year **52**

16. Is demolition or physical renovation at an existing facility involved? ☐ **YES** ■ **NO**

17. **Risk Management Plans.** If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your **Risk Management Plan (RMP)** to U. S. EPA Region III.

18. **Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process *(if known)*. A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance *(if known)*. Provide this information as **Attachment D. See Attachment D**

Section II. Additional attachments and supporting documents.

19. Include a check payable to WVDEP – Division of Air Quality with the appropriate **application fee** (per 45CSR22 and 45CSR13). **Included**

20. Include a **Table of Contents** as the first page of your application package. **Included**

21. Provide a **Plot Plan,** e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as **Attachment E** (Refer to ***Plot Plan Guidance***) .
➪ Indicate the location of the nearest occupied structure (e.g. church, school, business, residence). **See Attachment E**

22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as **Attachment F. See Attachment F**

23. Provide a **Process Description** as **Attachment G. See Attachment G**
➪ Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as Attachment H.

⇨ For chemical processes, provide a MSDS for each compound emitted to the air. **Generator Spec Sheets for Attachment H**

25. Fill out the **Emission Units Table** and provide it as **Attachment I. See Attachment I**

26. Fill out the **Emission Points Data Summary Sheet (Table 1 and Table 2)** and provide it as **Attachment J. See Attach J**

27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as **Attachment K.**

28. Check all applicable **Emissions Unit Data Sheets** listed below:

- ☐ Bulk Liquid Transfer Operations
- ☐ Chemical Processes
- ☐ Concrete Batch Plant
- ☐ Grey Iron and Steel Foundry
- ☐ General Emission Unit, specify
- ■ Haul Road Emissions
- ☐ Hot Mix Asphalt Plant
- ☐ Incinerator
- ☐ Indirect Heat Exchanger
- ☐ Quarry
- ☐ Solid Materials Sizing, Handling and Storage Facilities
- ☐ Storage Tanks

Fill out and provide the **Emissions Unit Data Sheet(s)** as **Attachment L.**

29. Check all applicable **Air Pollution Control Device Sheets** listed below:

- ☐ Absorption Systems
- ☐ Adsorption Systems
- ☐ Afterburner
- ■ Baghouse
- ☐ Condenser
- ☐ Electrostatic Precipitator
- ☐ Flare
- ☐ Mechanical Collector
- ☐ Wet Collecting System

☐ Other Collectors, specify: **see Attachment M**

Fill out and provide the Air Pollution Control Device Sheet(s) as Attachment M.

30. Provide all **Supporting Emissions Calculations** as **Attachment N,** or attach the calculations directly to the forms listed in Items 28 through 31. **See Attachment N**

31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O. See Attachment O**

➢ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and ***Example Legal Advertisement*** for details). Please submit the **Affidavit of Publication** as **Attachment P** immediately upon receipt.

33. **Business Confidentiality Claims.** Does this application include confidential information (per 45CSR31)?

☐ **YES** ■ **NO**

➢ If **YES,** identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's ***"Precautionary Notice – Claims of Confidentiality"*** guidance found in the ***General Instructions*** as **Attachment Q.**

35A. **Certification of Information.** To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

Certification of Truth, Accuracy, and Completeness

I, the undersigned ■ **Responsible Official** / ☐ **Authorized Representative,** hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE ____________________ (signed) *(Please use blue ink)* DATE: 4-12-15 *(Please use blue ink)*

35B. Printed name of signee: **PAUL MCCOY**		35C. Title: **Managing Member**
35D. E-mail: **pmccoy@everett-energy.com**	36E. Phone: **606-794-5306**	36F. FAX:
36A. Printed name of contact person (if different from above): **Glen Ousley**		36B. Title: **Manager**
36C. E-mail: **gousley@everett-energy.com**	36D. Phone: **606-794-5306**	36E. FAX:

PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:

- ■ Attachment A: Business Certificate
- ■ Attachment B: Map(s)
- ■ Attachment C: Installation and Start Up Schedule
- ■ Attachment D: Regulatory Discussion
- ■ Attachment E: Plot Plan
- ■ Attachment F: Detailed Process Flow Diagram(s)
- ■ Attachment G: Process Description
- ■ Attachment H: Generator Spec Sheets
- ■ Attachment I: Emission Units Table
- ■ Attachment J: Emission Points Data Summary Sheet
- ■ Attachment K: Fugitive Emissions Data Summary Sheet
- ■ Attachment L: Emissions Unit Data Sheet(s)
- ■ Attachment M: Air Pollution Control Device Sheet(s)
- ■ Attachment N: Supporting Emissions Calculations
- ■ Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans
- ■ Attachment P: Public Notice
- ■ Attachment Q: Toxicity of Criteria Pollutants
- ■ Attachment R: Mineral Separation Technology
- ☐ Attachment S: Title V Permit Revision Information
- ■ Application Fee

Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.

FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:

- ☐ *Forward 1 copy of the application to the Title V Permitting Group and:*
- ☐ *For Title V Administrative Amendments:*
  - ☐ *NSR permit writer should notify Title V permit writer of draft permit,*
- ☐ *For Title V Minor Modifications:*
  - ☐ *Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,*
  - ☐ *NSR permit writer should notify Title V permit writer of draft permit.*
- ☐ *For Title V Significant Modifications processed in parallel with NSR Permit revision:*
  - ☐ *NSR permit writer should notify a Title V permit writer of draft permit,*
  - ☐ *Public notice should reference both 45CSR13 and Title V permits,*
  - ☐ *EPA has 45 day review period of a draft permit.*

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

State of West Virginia

Certificate

I, Natalie E. Tennant, Secretary of State of the State of West Virginia, hereby certify that

EVERETT ENERGY LLC

Control Number: 9A54E

a limited liability company, organized under the laws of the State of Delaware

has filed its "Application for Certificate of Authority" in my office according to the provisions of West Virginia Code §31B-10-1002. I hereby declare the organization to be registered as a foreign limited liability company from its effective date of April 10, 2014, until a certificate of cancellation is filed with our office.

Therefore, I hereby issue this

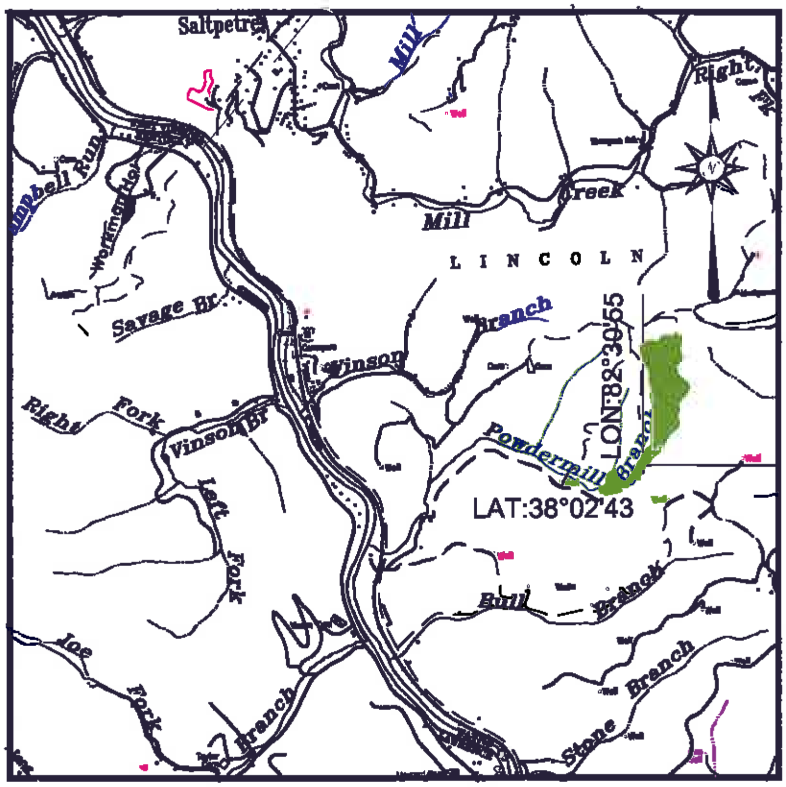
CERTIFICATE OF AUTHORITY OF A FOREIGN LIMITED LIABILITY COMPANY

to the limited liability company authorizing it to transact business in West Virginia

Given under my hand and t
Great Seal of the State
West Virginia on this day
April 10, 20

Natalie E. Tennant

Secretary of S



-LOCATION MAP-

Scale 1" = One Mile

EVERETT ENERGY, LLC

P.O. Box 211- Pikeville, KY 41502

Powdermill Branch
Dry Separation Facility

LOCATION MAP

Facility ID: Pending

Lon/Lat

Longitude: - 82 d 30 m 54.99013 s

Latitude: + 38 d 02 m 45.61313 s

DD: -82.515275 38.046004

Datum: NAD27 NAD83

Convert

UTM

Coordinates: 367038.96 E 4211797.15 N

Datum: NAD27 NAD83 Zone: 17

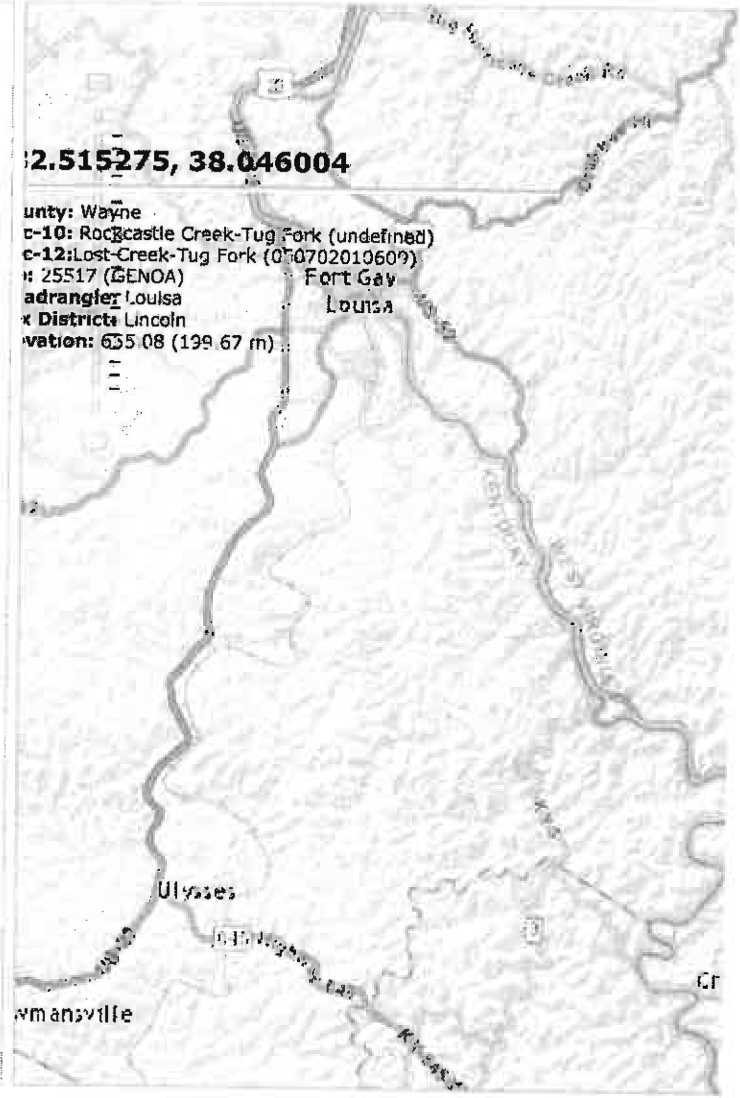
Convert

WV State Plane (feet)

Coordinates: 1131516.76 E -150792.07 N

Datum: NAD27 NAD83 Zone: North

Convert



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Attachment C

Installation and Start-Up Schedule

The proposed mineral separation unit will be installed on site upon approval by the Division of Air Quality. This writer estimates approval to be October 15, 2015.

REGULATORY APPLICABILITY

NESHAPS and PSD have no applicability to the facility. The proposed construction of a coal preparation plant will be subject to the following state and federal rules:

45CSR5 ***To Prevent and Control Air Pollution from the Operation of Coal Preparation Plants and Coal Handling Operations***

The proposed facility will be subject to the requirements of 45CSR5 because it will meet the definition of "Coal Preparation Plant" found in subsection 45CSR5.2.4. The facility should be in compliance with Section 3 (less than 20% opacity) and Section 6 (fugitive dust control system and dust control of the premises and access roads) when the particulate matter control methods and devices proposed are in operation.

45CSR13 ***Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits, and Procedures for Evaluation***

The proposed construction is subject to the requirements of 45CSR13 because it will result in a potential to discharge controlled emissions greater than six (6) pounds per hour and ten (10) tons per year of a regulated air pollutant (PM and PM_{10}) and involve the construction of equipment and open storage piles subject to NSPS Subpart Y.

45CSR16 ***Standards of Performance for New Stationary Sources***
40 CFR 60 ***Subpart Y: Standards of Performance for Coal Preparation and Processing Plants***

This proposed coal preparation plant will be subject to 40 CFR 60 Subpart Y because it will be constructed after October 24, 1974 and will process 200 tons of coal per day. The facility should be in compliance with Section 254(b) (less than 10% opacity for coal processing and conveying equipment, coal storage systems, or coal transfer and loading systems processing coal constructed, re-constructed or modified after April 28, 2008) when the particulate matter control methods and devices proposed are in operation.

The owner or operator of an open storage pile, which includes the equipment used in the loading, unloading, and conveying operations of the affected facility, constructed, reconstructed, or modified after

May 27, 2009, must prepare and operate in accordance with a submitted fugitive coal dust emissions control plan that is appropriate for the site conditions. The fugitive coal dust emissions control plan must identify and describe the control measures the owner or operator will use to minimize fugitive coal dust emissions from each open storage pile. The plan must be submitted to the Director prior to startup of the new, reconstructed or modified open storage pile.

45CSR16 Standards of Performance for New Stationary Sources
40 CFR 60 Subpart IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

The provisions of Subpart IIII are applicable to owners and operators of stationary compression ignition (CI) internal combustion engines (ICE) which are manufactured after April 1, 2006, are not fire pump engines and commence construction after July 11, 2005. For the purposes of Subpart IIII, the date that construction commences is the date the engine is ordered by the owner or operator.

The Powerscreen Warrior 1800 will be powered by a 2013 model 111.3 hp Caterpillar C4.4 diesel engine. In accordance with § 60.4200 (2), this engine is subject to Subpart IIII because it was manufactured after April 1, 2006 and commenced construction after July 11, 2005.

In accordance with § 60.4207(b), "Beginning October 1, 2010, owners and operators of stationary CI ICE subject to this subpart with a displacement of less than 30 liters per cylinder that use diesel fuel must use diesel fuel that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel."

40 CFR 89 Control of Emissions From New and In-use Nonroad Compression-Ignition Engines

This part applies to all compression-ignition nonroad engines except those specified in paragraph (b) of this section. This means that the engines for which this part applies include but are not limited to compression-ignition engines exempted from the requirements of 40 CFR Part 92 by 40 CFR 92.207 or 40 CFR Part 94 by 40 CFR 94.907. This part applies as specified in 40 CFR part 60 subpart IIII, to compression-ignition engines subject to the standards of 40 CFR part 60, subpart IIII.

45CSR30 Requirements for Operating Permits

In accordance with 45CSR30 Major Source Determination, this proposed coal preparation plant is not listed in 45CSR30 subsection 2.26.b as one of the categories of stationary sources which must include fugitive emissions (open storage piles constructed or modified on or before May 27, 2009 and haulroads) when determining whether it is a major stationary source for the purposes of § 302(j) of the Clean Air Act. The facility's new potential to emit will be 3.94 TPY for PM_{10} (open storage piles constructed or modified after May 27, 2009 and point sources combined), which is less than the 45CSR30 threshold of 100 TPY of a regulated air pollutant used to define a major stationary source. Therefore, the facility will be subject to 45CSR30 and remain classified as a Title V deferred non-major source.

The proposed construction of a coal preparation plant will not be subject to the following state and federal rules:

45CSR14 Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration

In accordance with 45CSR14 Major Source Determination, this coal preparation plant is not one of the 100 TPY stationary sources listed under the definition of "Major Stationary Source" in subsection 2.43.a. Therefore, it must have the potential to emit 250 TPY or more of any regulated pollutant to meet the definition of a major source in subsection 2.43.b. At the end of subsection 2.4.3, this facility is not listed in Table 1 - Source Categories Which Must Include Fugitive Emissions. So, fugitive emissions (from open storage piles constructed or modified on or before May 27, 2009 and haulroads) are not included when determining major stationary source applicability. The facility's new potential to emit will be 8.33 TPY for PM (open storage piles constructed or modified after May 27, 2009 and point sources combined), which is less than the 45CSR14 threshold of 250 TPY for a regulated air pollutant used to define a major stationary source. Therefore, the proposed construction is not subject to the requirements set forth within 45CSR14.

40 CFR 63 Subpart ZZZZ: National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

According to the RICE NESHAP Summary of Requirements, new and reconstructed stationary non-emergency compression ignition engine constructed on or after June 12, 2006 and located at an area source of HAP are subject to 40 CFR part 60, subpart IIII (Standards

of Performance for Stationary Compression Ignition Internal Combustion Engines).

DETAILED PROCESS DESCRIPTION

The FGX Material Separation Unit will be located in a remote area of the Powder Mill Surface Mine in Wayne County, WV. The 120TPH system will include a feed bin, raw coal feed belt, a FGX-12 separation unit that is essentially a screen and 6 reclaim belts for stockpile storage. The separation unit will produce three products: clean raw coal, middlings, and refuse or rock. Four baghouses will be employed to filter dust from the separation unit.

Raw coal will be delivered to open stockpile OS-01 @ TP-01(UL-MDH); transfer by front-end loader to feed bin BS-01(PE) @ TP-02(UD-MDH); discharge to belt conveyor BC-01(NC) @ TP-03(TC-FE); to the feed bin for the separation unit BS-02(PE) @ TP-04(TC-MDH). Material will be fed @ TP-05(TC-BH) to the 120 TPH triple deck screen SS-01(FE/BH) for air separation. Raw clean coal will discharge to belt conveyor BC-02(NC) @ TP-06(TC-FE); transfer to stacker belt BC-03(NC) @ TP-07(TC-MDH); to open stockpile OS-02(SW-WS) @ TP-08(TC-MDH); and loadout to truck for delivery @ TP-09(LO-MDH). Middlings coal will discharge to belt conveyor BC-04(NC) @ TP-10(TC-FE); transfer to stacker belt BC-05(NC) @ TP-11(TC-MDH); to open stockpile OS-03(SW-WS) @ TP-12(TC-MDH); and loadout to truck for delivery @ TP-13(LO-MDH). Refuse will discharge to belt conveyor BC-06(NC) @ TP-14(TC-FE); transfer to stacker belt BC-07(NC) @ TP-15(TC-MDH); to open stockpile OS-04(SW-WS) @ TP-16(TC-MDH); and loadout to truck @ TP-17(LO-MDH) for delivery to the disposal area @ TP-18(UL-MDH).

ATTACHMENT G

A water truck equipped with pumps and sprays sufficient to control fugitive dust will be used to control stockpile emissions.

DIESEL GENERATOR SET

CAT®

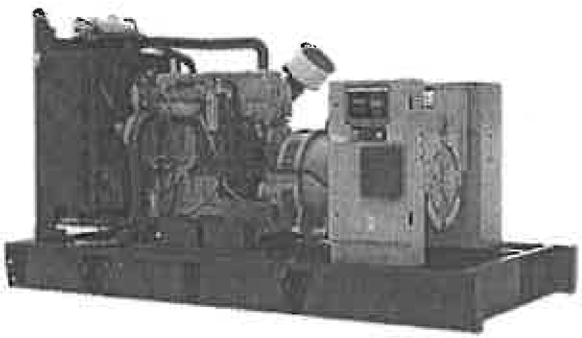


Image shown may not reflect actual package.

PRIME
320 ekW 400 kVA
60 Hz 1800 rpm 480 Volts

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

FEATURES

FUEL/EMISSIONS STRATEGY
- EPA Certified for Stationary Emergency Application (EPA Tier 3 emissions levels)

DESIGN CRITERIA
- The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response

UL 2200 / CSA – Optional
- UL 2200 Listed packages
- CSA Certified

Certain restrictions may apply.
Consult with your Cat® Dealer.

FULL RANGE OF ATTACHMENTS
- Wide range of bolt-on system expansion attachments, factory designed and tested
- Flexible packaging options for easy and cost effective installation

SINGLE-SOURCE SUPPLIER
- Fully prototype tested with certified torsional vibration analysis available

WORLDWIDE PRODUCT SUPPORT
- Cat dealers provide extensive post sale support including maintenance and repair agreements
- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- The Cat S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

CAT C15 ATAAC DIESEL ENGINE
- Utilizes ACERT™ Technology
- Reliable, rugged, durable design
- Field-proven in thousands of applications worldwide
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight
- Electronic controlled governor

CAT GENERATOR
- Matched to the performance and output characteristics of Cat engines
- UL 1446 Recognized Class H insulation
- CSA Certified

CAT EMCP 4 CONTROL PANELS
- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway
- Integrated Voltage Regulation

SEISMIC CERTIFICATION
- Seismic Certification available
- Anchoring details are site specific, and are dependent on many factors such as generator set size, weight, and concrete strength.

  IBC Certification requires that the anchoring system used is reviewed and approved by a Professional Engineer
- Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012, CBC 2007, CBC 2010

FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	• Disposable air filter	[ ] Canister type, dual element [ ] Heavy duty air cleaner
Cooling	• Package mounted radiator	
Exhaust	• Exhaust flange outlet	[ ] Industrial [ ] Residential / Critical
Fuel	• Primary fuel filter with integral water separator • Secondary fuel filters • Fuel priming pump	
Generator	• Matched to the performance and output characteristics of Cat engines • IP23 Protection	[ ] Permanent magnet excitation (PMG) [ ] Anti-condensation space heater [ ] Internal excitation (IE) [ ] Coastal insulation protection
Power Termination	• Power terminal strips	[ ] Circuit breakers – 100% rated assembly, UL Listed [ ] SUSE (Suitable for use as service equipment)
Control Panels	• EMCP 4.2	[ ] EMCP 4.3 [ ] EMCP 4.4 [ ] Local and remote annunciator modules [ ] Remote monitoring software
Mounting	• Rubber vibration isolators	
Starting/Charging	• 24 volt starting motor & charging alternator • Batteries	[ ] Battery chargers [ ] Oversize batteries [ ] Jacket water heater
General	• Paint - Caterpillar Yellow except rails and radiators gloss black • Narrow skid base	The following options are based on regional and product configuration: [ ] Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012, CBC 2007, CBC 2010 [ ] UL 2200 Listed package [ ] CSA Certified [ ] Wide skid base [ ] Sound attenuated enclosure [ ] Weather protective enclosure [ ] Integral dual wall UL Listed 8 hr fuel tank [ ] Sub-base dual wall UL Listed 24 hr fuel tank [ ] Sub-base dual wall UL Listed 48 hr fuel tank

SPECIFICATIONS

STANDARD CAT GENERATOR	
Frame size	LC6114B
Excitation	Self Excitation
Pitch	0.6667
Number of poles	4
Number of bearings	Single bearing
Number of leads	12
Insulation	UL 1446 Recognized Class H with tropicalization and antiabrasion
IP Rating	IP23
Alignment	Pilot shaft
Overspeed capability (%)	125
Wave form deviation (%)	2
Voltage regulator	Three phase sensing
Voltage regulation	+/- 0.25% (steady state)
– Consult your Cat dealer for other available voltages	

CAT DIESEL ENGINE	
C18 ATAAC, I-6, 4-Stroke Water-cooled Diesel	
Bore	137.20 mm (5.4 in)
Stroke	171.40 mm (6.75 in)
Displacement	15.20 L (927.56 in³)
Compression ratio	16.1:1
Aspiration	Air-to-air aftercooled
Fuel system	MEUI
Governor type	Caterpillar ADEM control system

CAT EMCP 4 SERIES CONTROLS

EMCP 4 controls including:
- Run / Auto / Stop Control
- Speed and Voltage Adjust
- Engine Cycle Crank
- 24-volt DC operation
- Environmental sealed front face
- Text alarm/event descriptions

Digital indication for:
- RPM
- DC volts
- Operating hours
- Oil pressure (psi, kPa or bar)
- Coolant temperature
- Volts (L-L & L-N), frequency (Hz)
- Amps (per phase & average)
- ekW, kVA, kVAR, kW-hr, %kW, PF (4.2 only)

Warning/shutdown with common LED indication of:
- Low oil pressure
- High coolant temperature
- Overspeed
- Emergency stop
- Failure to start (overcrank)
- Low coolant temperature
- Low coolant level

Programmable protective relaying functions:
- Generator phase sequence
- Over/Under voltage (27/59)
- Over/Under Frequency (81 o/u)
- Reverse Power (kW) (32) (4.2 only)
- Reverse reactive power (kVAr) (32RV)
- Overcurrent (50/51)

Communications:
- Four digital inputs (4.1)
- Six digital inputs (4.2 only)
- Four relay outputs (Form A)
- Two relay outputs (Form C)
- Two digital outputs
- Customer data link (Modbus RTU) (4.2 only)
- Accessory module data link (4.2 only)
- Serial annunciator module data link (4.2 only)
- Emergency stop pushbutton

Compatible with the following:
- Digital I/O module
- Local Annunciator
- Remote CAN annunciator
- Remote serial annunciator

PRIME 320 ekW 400 kVA

60 Hz 1800 rpm 480 Volts

TECHNICAL DATA

Open Generator Set - - 1800 rpm/60 Hz/480 Volts	DM8148	
EPA Certified for Stationary Emergency Application (EPA Tier 3 emissions levels)		
Generator Set Package Performance		
Genset power rating @ 0.8 pf	400.0 kVA	
Genset power rating with fan	320.0 ekW	
Fuel Consumption		
100% load with fan	101.9 L/hr	26.9 gal/hr
75% load with fan	82.4 L/hr	21.3 gal/hr
50% load with fan	61.4 L/hr	16.2 gal/hr
Cooling System[1]		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Air flow (max @ rated speed for radiator arrangement)	639 m^3/min	22566 cfm
Engine Coolant capacity with radiator/exp. tank	50.3L	13.3 gal
Engine coolant capacity	20.8 L	5.5 gal
Radiator coolant capacity	29.5 L	7.8 gal
Inlet Air		
Combustion air inlet flow rate	34.6 m^3/min	1221.9 cfm
Exhaust System		
Exhaust stack gas temperature	484.0°C	903.2°F
Exhaust gas flow rate	91.6 m^3/min	3234.8 cfm
Exhaust flange size (internal diameter)	152.4 mm	6.0 in
Exhaust system backpressure (maximum allowable)	10.0 kPa	40.2 in. water
Heat Rejection		
Heat rejection to coolant (total)	147 kW	8360 Btu/min
Heat rejection to exhaust (total)	405 kW	23032 Btu/min
Heat rejection to aftercooler	87.3 kW	4965 Btu/min
Heat rejection to atmosphere from engine	71.0 kW	4038 Btu/min
Heat rejection to atmosphere from generator	21.9 kW	1245.5 Btu/min
Alternator[2]		
Motor starting capability @ 30% voltage dip	880 skVA	
Frame	LC6114B	
Temperature rise	105°C	189°F
Lubrication System		
Sump refill with filter	60.0 L	15.9 gal
Emissions (Nominal)[3]		
NOx g/hp-hr	2.96 g/hp-hr	
CO g/hp-hr	0.54 g/hp-hr	
HC g/hp-hr	0.05 g/hp-hr	
PM g/hp-hr	0.038 g/hp-hr	

[1] For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.

[2] Generator temperature rise is based on a 40° C (104° F) ambient per NEMA MG1-32. Some packages may have oversized generators with a different temperature rise and motor starting characteristics.

[3] Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77°F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

RATING DEFINITIONS AND CONDITIONS

Applicable Codes and Standards:
AS1359, CSA C22.2 No100-04, UL142,UL489, UL869, UL2200, NFPA37, NFPA70, NFPA99, NFPA110, IBC, IEC60034-1, ISO3046, ISO8528, NEMA MG1-22,NEMA MG1-33, 72/23/EEC, 98/37/EC, 2004/108/EC.

Prime – Output available with varying load for an unlimited time. Average power output is 70% of the prime power rating. Typical peak demand is 100% of prime rated ekW with 10% overload capability for emergency use for a maximum of 1 hour in 12. Overload operation cannot exceed 25 hours per year.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions.

Fuel Rates are based on fuel oil of 35° API (16°C or 60°F) gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29°C (85°F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.).

Additional Ratings may be available for specific customer requirements. Consult your Cat representative for details.

DIMENSIONS

Package Dimensions		
Length	3361 mm	132.3 in
Width	1502 mm	59.1 in
Height	2127 mm	83.7 in

NOTE: For reference only – do not use for installation design. Please contact your local dealer for exact weight and dimensions.

Performance No.: DM8148

Feature Code: C15DECC

Gen. Arr. Number: 4183863

Source: U.S. Sourced

LEHE0472-00 (12/13)

www.Cat-ElectricPower.com

Attachment I

Emission Units Table

(includes all emission units and air pollution control devices that will be part of this permit application review, regardless of permitting status)

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type[3] and Date of Change	Control Device[4]
SS-01	TP-06	SEPERATION SCREEN	2015	120	NEW	FE-BH
BC-01	TP-04	BELT CONVEYOR	2015	120	NEW	NC
BC-02	TP-07	BELT CONVEYOR	2015	120	NEW	NC
BC-03	TP-08	BELT CONVEYOR	2015	120	NEW	NC
BC-04	TP-11	BELT CONVEYOR	2015	120	NEW	NC
BC-05	TP-12	BELT CONVEYOR	2015	120	NEW	NC
BC-06	TP-15	BELT CONVEYOR	2015	120	NEW	NC
BC-07	TP-16	BELT CONVEYOR	2015	120	NEW	NC
BS-01	TP-03	RECEIVING BIN	2015	10T	NEW	PE
BS-02	TP-05	RECEIVING BIN	2015	5T	NEW	PE

[1] For Emission Units (or Sources) use the following numbering system:1S, 2S, 3S,... or other appropriate designation.
[2] For Emission Points use the following numbering system:1E, 2E, 3E, ... or other appropriate designation.
[3] New, modification, removal
[4] For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.

Attachme J
EMISSION POINTS DATA SUMMARY SHEET

Table 1: Emissions Data

Emission Point ID No. *(Must match Emission Units Table & Plot Plan)*	Emission Point Type[1]	Emission Unit Vented Through This Point *(Must match Emission Units Table & Plot Plan)*		Air Pollution Control Device *(Must match Emission Units Table & Plot Plan)*		Vent Time for Emission Unit *(chemical processes only)*		All Regulated Pollutants - Chemical Name/CAS[3] *(Speciate VOCs & HAPS)*	Maximum Potential Uncontrolled Emissions[4]		Maximum Potential Controlled Emissions[5]		Emission Form or Phase *(At exit conditions, Solid, Liquid or Gas/Vapor)*	Est. Method Used[6]	Emission Concentration[7] (ppmv or mg/m^4)
		ID No.	Source	ID No.	Device Type	Short Term[2]	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
SS-01		**06**	**TP**		**FE/BH**			**Particulate Matter**	12.00	52.56	0.120	0.526	**Solid**	**MB**	
BC-01		**04**	**TP**		**NC**			**Particulate Matter**	0.122	0.534	0.122	0.534	**Solid**	**MB**	
BC-02		**07**	**TP**		**NC**			**Particulate Matter**	0.122	0.534	0.122	0.534	**Solid**	**MB**	
BC-03		**08**	**TP**		**NC**			**Particulate Matter**	0.122	0.534	0.122	0.534	**Solid**	**MB**	
BC-04		**11**	**TP**		**NC**			**Particulate Matter**	0.122	0.534	0.122	0.534	**Solid**	**MB**	
BC-05		**12**	**TP**		**NC**			**Particulate Matter**	0.122	0.534	0.122	0.534	**Solid**	**MB**	

BC-06		15	TP		NC			Particulate Matter	0.122	0.534	0.122	0.534	Solid	MB	
BC-07		16	TP		NC			Particulate Matter	0.122	0.534	0.122	0.534	Solid	MB	
BS-01		03	TP		PE			Particulate Matter	0.122	0.534	0.122	0.534	Solid	MB	
BS-02		05	TP		PE			Particulate Matter	0.122	0.534	0.001	0.005	Solid	MB	

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

1 Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.

2 Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).

3 List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. **LIST** Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. **DO NOT LIST** H_2, H_2O, N_2, O_2, and Noble Gases.

4 Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

5 Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

6 Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

7 Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter (mg/m^3) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO_2, use units of ppmv (See 45CSR10).

Attachment K

FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not typically considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.

Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions).

APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS
1.) Will there be haul road activities? ■ Yes ☐ No ■ If YES, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.
2.) Will there be Storage Piles? **Please see calculation spreadsheet for emissions** ■ Yes ☐ No ■ If YES, complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.
3.) Will there be Liquid Loading/Unloading Operations? ☐ Yes ■ No ☐ If YES, complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.
4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation? ☐ Yes ■ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
5.) Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)? ☐ Yes ■ No ☐ If YES, complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.
6.) Will there be General Clean-up VOC Operations? ☐ Yes ■ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
7.) Will there be any other activities that generate fugitive emissions? ☐ Yes ■ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form.
If you answered "NO" to all of the items above, it is not necessary to complete the following table, "Fugitive Emissions Summary."

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants - Chemical Name/CAS[1]	Maximum Potential Uncontrolled Emissions[2]		Maximum Potential Controlled Emissions[3]		Est. Method Used[4]
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads						
Unpaved Haul Roads	**Particulate Matter** **PM10**	**150.92** **43.62**	**661.02** **191.04**	**45.28** **13.08**	**198.31** **57.31**	**MB**
Storage Pile Emissions	**Particulate Matter** **PM10**	**0.547** **0.257**	**2.395** **1.126**	**0.137** **0.064**	**0.599** **0.281**	**MB**
Loading/Unloading Operations						
Wastewater Treatment Evaporation & Operations						
Equipment Leaks		**Does not apply**		**Does not apply**		
General Clean-up VOC Emissions						
Other						

[1] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. DO NOT LIST H_2, H_2O, N_2, O_2, and Noble Gases.

[2] Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[3] Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[4] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

Attachment L
FUGITIVE EMISSIONS FROM UNPAVED HAULROADS

UNPAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)

		PM	PM-10
k =	Particle size multiplier	0.80	0.36
s =	Silt content of road surface material (%)	9	9
p =	Number of days per year with precipitation >0.01 in.	157	157

Item Number	Description	Number of Wheels	Mean Vehicle Weight (tons)	Mean Vehicle Speed (mph)	Miles per Trip	Maximum Trips per Hour	Maximum Trips per Year	Control Device ID Number	Control Efficiency (%)
1	Material In	6	60	15	0.5	3	17,520	HR-WS	70
2	Final Product	14	30	15	1	4	35,040	HR-WS	70
3	Middlings	14	30	15	1	4	35,040	HR-WS	70
4	Reject	14	30	15	1	4	35,040	HR-WS	70
5									
6									
7									
8									

Source: *AP-42 Fifth Edition – 13.2.2 Unpaved Roads*

$E = k \times 5.9 \times (s \div 12) \times (S \div 30) \times (W \div 3)^{0.7} \times (w \div 4)^{0.5} \times ((365 - p) \div 365) =$ lb/Vehicle Mile Traveled (VMT)

Where:

		PM	PM-10
k =	Particle size multiplier	0.80	0.36
s =	Silt content of road surface material (%)	9	9
S =	Mean vehicle speed (mph)	15	15
W =	Mean vehicle weight (tons)	45	45
w =	Mean number of wheels per vehicle	18	18
p =	Number of days per year with precipitation >0.01 in.	157	157

For lb/hr: [lb ÷ VMT] × [VMT ÷ trip] × [Trips ÷ Hour] = lb/hr

For TPY: [lb ÷ VMT] × [VMT ÷ trip] × [Trips ÷ Hour] × [Ton ÷ 2000 lb] = Tons/year

SUMMARY OF UNPAVED HAULROAD EMISSIONS

Item No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
1	15.42	67.56	4.63	20.27	4.46	19.52	1.34	5.86
2	45.16	197.82	13.55	59.35	13.05	57.17	3.92	17.15
3	45.16	197.82	13.55	59.35	13.05	57.17	3.92	17.15
4	45.16	197.82	13.55	59.35	13.05	57.17	3.92	17.15
5								
6								
7								
8								
TOTALS	150.92	661.02	45.28	198.31	43.62	191.04	13.08	57.31

FUGITIVE EMISSIONS FROM PAVED HAULROADS

INDUSTRIAL PAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)

I =	Industrial augmentation factor (dimensionless)	
n =	Number of traffic lanes	
s =	Surface material silt content (%)	
L =	Surface dust loading (lb/mile)	

Item Number	Description	Mean Vehicle Weight (tons)	Miles per Trip	Maximum Trips per Hour	Maximum Trips per Year	Control Device ID Number	Control Efficiency (%)
1	NONE						
2							
3							
4							
5							
6							
7							
8							

Source: *AP-42 Fifth Edition – 11.2.6 Industrial Paved Roads*

$E = 0.077 \times I \times (4 \div n) \times (s \div 10) \times (L \div 1000) \times (W \div 3)^{0.7} =$ lb/Vehicle Mile Traveled (VMT)

Where:

I =	Industrial augmentation factor (dimensionless)	
n =	Number of traffic lanes	
s =	Surface meterial silt content (%)	
L =	Surface dust loading (lb/mile)	
W =	Average vehicle weight (tons)	

For lb/hr: [lb ÷ VMT] × [VMT ÷ trip] × [Trips ÷ Hour] = lb/hr

For TPY: [lb ÷ VMT] × [VMT ÷ trip] × [Trips ÷ Hour] × [Ton ÷ 2000 lb] = Tons/year

SUMMARY OF PAVED HAULROAD EMISSIONS

Item No.	Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY
1				
2				
3				
4				
5				
6				
7				
8				
TOTALS				

 Revision 03/2007

BAGHOUSE AIR POLLUTION CONTROL DEVICE SHEET

Complete a Baghouse Air Pollution Control Device Sheet for each baghouse control device.

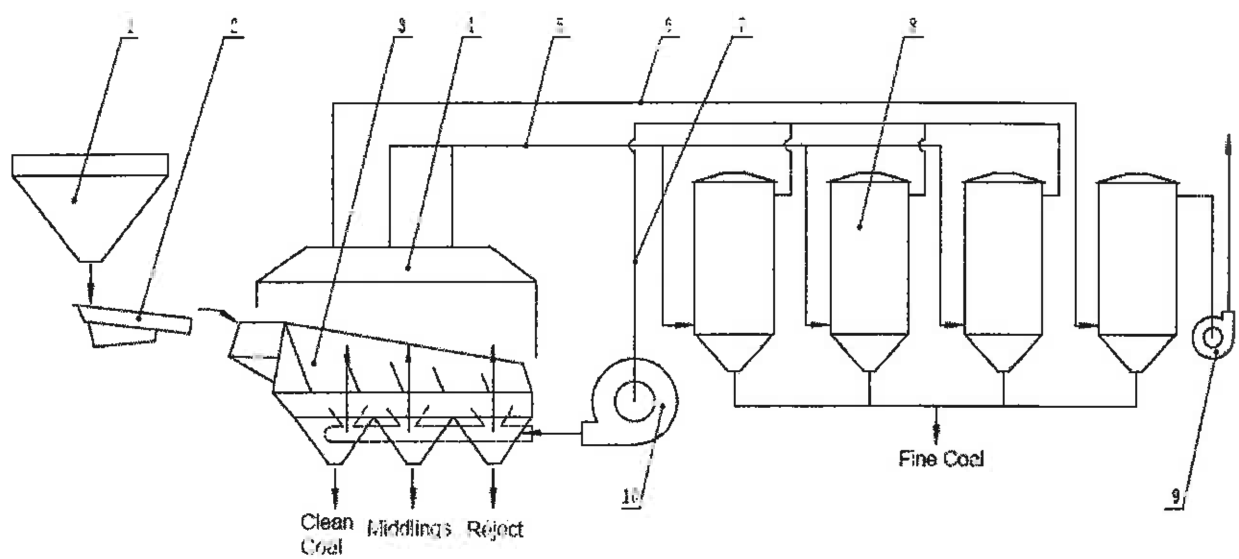
1. Baghouse Control Device Identification Number:
   FGX-12-4
2. Manufacturer's name and model identification:
   Manufacturer's name :Tangshan Shengzhou Manufacturing Co.,Ltd. China(TSM)
   Model ID:LHF-144 610/530
3. Number of compartments in baghouse:
   Total of Four Baghouses in our FGX system, in the baghouse, no compartments.
4. Number of compartments online during normal operation and conditions:
   Four baghouses running at the same time.
5. Gas flow rate into baghouse: 88,262 ACFM @ 190LB/MMSCF EF and 0.29 PSIA
6. Total cloth area: 26,288 ft^2
7. Operating air to cloth ratio: 3.35 ft/min
8. Filter media type: three defense polyester needle felt (waterproof, oil, anti-static)
9. Stabilized static pressure drop across baghouse: 2.408 inches H_2O
10. Baghouse operation is:
    G Continuous G Automatic G Intermittent
11. Method used to clean bags:
    G Shaker G Pulse jet G Reverse jet G Other
12. Emission rate of particulate matter entering and exiting baghouse at maximum design operating conditions:
    Entering baghouse: 1600 lb/hr and 2.2 grains/ACF
    Exiting baghouse: 5.5 lb/hr and 0.022 grains/ACF
13. Guaranteed minimum baghouse collection efficiency: 99 %
14. Provide a written description of the capture system (e.g. hooding and ductwork arrangement), size of ductwork and hoods and air volume, capacity and operating horsepower of fan:

The whole dust collection system includes 4 dust collector units which connect with one dust collection hood by two dust collection pipes (ductwork). The hood's size is 14.71 square meters. Total air volume under the hood: 88262 ACFM

Two ductworks (dust collection pipes) connect to both the top of the hood and 4 dust collector units. One ductwork (dust collection pipe) connects one single dust collector unit which releases the gas stream to the atmosphere through a 45KW draft fan. Diameter of the pipe: 39.37 inches. Gas stream flow rate of the inlet of the single dust collector: 29428 ACFM.

The second ductwork (dust collection pipe) connects to three dust collector units. Air in the pipe passes through those three collectors and the main fan (250KW), and then back to the dust collection hood forming a closed loop. No air is released into the atmosphere during the processing. Diameter of the second pipe: 43.82 inches, Gas stream flow rate of the inlet of the three dust collectors: 58834 ACFM.

FGX - 12 Compound Dry Coal Separator Flow Sheet



1. Surge Bin 2. Feeder 3. Main Separator 4. Hood 5. Main Fan Ductwork 6. Draft Fan Duckwork 7. Main Fan Air Inlet Pipe 8. Baghouse 9. Draft Fan 10. Main Fan

Note:

1. Main Fan: Air flow rate: 66935 - 128405 square meters/hour; Full Air Pressure: 7196 - 4778 Pa; Motor Power: 250KW
2. Draft Fan: Air flow rate: 48195 -80397 square meters/hour; Full air Pressure: 2185 - 1969 Pa; Motor Power: 45 KW
3. Area of the Dust Collection Hood: 14.71 square meters; Diameter of air inlet pipe of Main Fan: 1150 mm; Diameter of Main Fan Ductwork: 1150 mm; Diameter of Draft Fan Ductwork: 1000 mm

Everett Energy, LLC **Dan Roberts**
Coal Preparation Plant - FGX Separator **ID No. Pending** **4/22/2015**

TERIA POLLUTANTS

AP-42 5th Edition Section 3.3 Gasoline and Diesel Industrial Engines (10/96) - Table 3.3-1 for Diesel Fuel

	320	**kW**
Caterpillar C15 Diesel Fuel Engine	**450**	**hp**
Max. Hours of Operation (12 hrs/day, 5 days/week, 26 weeks/year)	**2500**	**hrs/year**
Heating Value for diesel	**128700**	**Btu/gal**

E (hourly) = Emission Factor (lb/hp-hr) * Horse Power (hp)
E (annual) = Emission Factor (lb/hp-hr) * Horse Power (hp) * Maximum Hours of Operation * 1 ton per 2000 lb

Pollutant		**Emission Factor (lb/hp-hr)**	**Emission Factor (lb/MMBtu)**	**Rating**	**lb/hour**	**TPY**
NOx	AP42	0.03100	4.41	D	13.9500	17.438
CO	AP42	0.00668	0.95	D	3.0060	3.758
SOx	AP42	0.00205	0.29	D	0.9225	1.153
PM/PM10	AP42	0.00220	0.31	D	0.9900	1.238
VOC	AP42	0.00247	0.35	D	1.1115	1.389

HAZARDOUS AIR POLLUTANTS

, 12 5th Edition Section 3.3 Gasoline and Diesel Industrial Engines (10/96) - Table 3.3-2
45CSR30 Table 45-30A Hazardous Air Pollutants

Caterpillar C15 Diesel Fuel Engine	**450**	**hp**
cimum Hours of Operation (10 hrs/day, 5 days/week, 50 weeks/year)	**2500**	**hours/year**
cation, based on EPA WebFIRE/AP-42 3.4-1 assumptions on diesel	**19000**	**Btu/lb**
	7.1	**lb/gal**
Heating Value for diesel	**134900**	**BTU/US gal**
Maximum diesel usage at 1800 rpm	**13.9**	**gal/hour**

E (hourly) = Emission Factor (lb/hp-hr) * Horse Power (hp)
E (annual) = Emission Factor (lb/hp-hr) * Horse Power (hp) * Maximum Hours of Operation * 1 ton per 2000 lb

CAS NO.		**Emission Factor (lb/MMBtu)**	**Rating**	**lb/hour**	**TPY**
71-43-2	Benzene	0.000933	E	0.00175	0.002187
108-88-3	Toluene	0.000409	E	0.00077	0.000959
	Xylenes	0.000285	E	0.00053	0.000668
	1,3-Butadiene	0.0000391	E	7.3E-05	9.16E-05
50-00-0	Formaldehyde	0.00118	E	0.00221	0.002766
	Acetaldehyde	0.000767	E	0.00144	0.001798
	Acrolein	0.0000925	E	0.00017	0.000217
91-20-3	Naphthalene	0.0000848	E	0.00016	0.000199
	Burning diesel fuel:		***Total HAPs***	**0.00711**	**0.008884**
				lb/hour	**TPY**

INPUTS

Include all information for each emission source and transfer point as listed in the permit application.

Name of applicant: **Everett Energy**
Name of plant: **Powder Mill Plant**
Apr-15

1. CRUSHING AND SCREENING (including all primary and secondary crushers and screens)

1a. PRIMARY CRUSHING

Primary Crusher ID Number	Description	Maximum Material Processing Capacity TPH	Maximum Material Processing Capacity TPY	Control Device ID Number	Control Efficiency %

1b. SECONDARY AND TERTIARY CRUSHING

Secondary & Tertiary Crusher ID	Description	Maximum Material Processing Capacity TPH	Maximum Material Processing Capacity TPY	Control Device ID Number	Control Efficiency %

1c. SCREENING

Screen ID	Description	Maximum Material Processing Capacity TPH	Maximum Material Processing Capacity TPY	Control Device ID Number	Control Efficiency %
SS-01	Primary Vibrating Screen	120	1,051,200	FE-BH	99

2. *TRANSFER POINTS (including all conveyor transfer points, equipment transfer points etc.)*

		PM	PM-10
k =	Particle Size Multiplier (dimensionless)	0.74	0.35
U =	Mean Wind Speed (mph)	7	

Transfer Point ID No.	Transfer Point Description Include ID Numbers of all conveyors, crushers, screens, stockpiles, etc. involved	Material Moisture Content %	Maximum Transfer Rate TPH	Maximum Transfer Rate TPY	Control Device ID Number	Control Efficiency %
TP01	Truck to OS-01	5	120	1,051,200	UL-MDH	0
TP02	OS-01 to BS-01	5	120	1,051,200	UD-MDH	0
TP03	BS-01 to BC-01	5	120	1,051,200	TC-MDH	0
TP04	BC-01 to BS-02	5	120	1,051,200	TC-MDH	0
TP05	BS-02 to SS-01	5	120	1,051,200	TC-BH	99
TP06	SS-01 to BC-02	5	120	1,051,200	TC-FE	80
TP07	BC-02 to BC-03	5	120	1,051,200	TC-MDH	0
TP08	BC-03 to OS-02	5	120	1,051,200	TC-MDH	0
TP09	OS-02 to Truck	5	120	1,051,200	LD-MDH	0
TP10	SS-01 to BC-04	5	120	1,051,200	TC-FE	80
TP11	BC-04 to BC-05	5	120	1,051,200	TC-MDH	0
TP12	BC-05 to OS-03	5	120	1,051,200	TC-MDH	0
TP13	OS-03 to Truck	5	120	1,051,200	LD-MDH	0
TP14	SS-01 to BC-06	5	120	1,051,200	TC-FE	80
TP15	BC-06 to BC-07	5	120	1,051,200	TC-MDH	0
TP16	BC-07 to OS-04	5	120	1,051,200	TC-MDH	0
TP17	OS-04 to Truck	5	120	1,051,200	LD-MDH	0
TP-18	Truck to disposal area	5	120	1,051,200	UL-MDH	0

3. *WIND EROSION OF STOCKPILES (including all stockpiles of raw coal, clean coal, coal refuse, etc.)*

p =	number of days per year with precipitation >0.01 inch	157
f =	percentage of time that the unobstructed wind speed exceeds 12 mph at the mean pile height	20

Source ID No.	Stockpile Description	Silt Content of Material %	Stockpile base area Max. sqft	Control Device ID Number	Control Efficiency %
OS-01	Raw Coal Stockpile	5	38,869	SW-WS	75
OS-02	Raw Coal Stockpile	5	18,869	SW-WS	75
OS-03	Middlings Stockpile	5	18,869	SW-WS	75
OS-04	Refuse Stockpile	5	8,869	SW-WS	75

4. *UNPAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)*

s =	silt content of road surface material (%)	9
p =	number of days per year with precipitation >0.01 inch	157
M_{dry} =	surface material moisture content (%) - dry conditions	0.2

Item Number	Description		Number of wheels	Mean Vehicle Weight(tons)	Mean Vehicle Speed (mph)	Miles per Trip	Maximum Trips Per Hour	Maximum Trips Per Year	Control Device ID Number	Control Efficiency %
1	Material In	1,051,200	6	60	15	0.5	2	17,520	HR-WS	70
2	Raw Coal	1,051,200	14	30	15	1	4	35,040	HR-WS	70
3	Raw Coal	1,051,200	14	30	15	1	4	35,040	HR-WS	70
4	Reject	1,051,200	14	30	15	1	4	35,040	HR-WS	70
5										
6										
7										
8										

5. *INDUSTRIAL PAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)*

sL =	road surface silt loading, (g/ft^2)	1
P =	number of days per year with precipitation >0.01 inch	157

Item Number	Description	Mean Vehicle Weight (tons)	Miles per Trip	Maximum Trips Per Hour	Maximum Trips Per Year	Control Device ID Number	Control Efficiency %
1							
2							
3							
4							
5							
6							
7							
8							

EMISSIONS SUMMARY

Name of applicant: Everett Energy
Name of plant: Powder Mill Plant

Particulate Matter or PM (for 45CSR14 Major Source Determination)

	Uncontrolled PM		Controlled PM	
	lb/hr	TPY	lb/hr	TPY
FUGITIVE EMISSIONS				
Stockpile Emissions	0.55	2.39	0.14	0.60
Unpaved Haulroad Emissions	150.92	661.02	45.28	198.31
Paved Haulroad Emissions	0.00	0.00	0.00	0.00
Fugitive Emissions Total	**151.47**	**663.42**	**45.41**	**198.91**
POINT SOURCE EMISSIONS				
Equipment Emissions	12.00	52.56	0.12	0.53
Transfer Point Emissions	2.20	9.62	1.78	7.81
Point Source Emissions Total*	**14.20**	**62.18**	**1.90**	**8.33**
Facility Emissions Total	**165.66**	**725.60**	**47.31**	**207.24**

*Note: Point Source Total Controlled PM TPY emissions is used for 45CSR14 Major Source determination (see below)

***Facility Potential to Emit (PTE) (Baseline Emissions) = 8.33**

(Based on Point Source Total controlled PM TPY emissions from above) **ENTER ON LINE 26 OF APPLICATION**

Particulate Matter under 10 microns, or PM-10 (for 45CSR30 Major Source Determination)

	Uncontrolled PM-10		Controlled PM-10	
	lb/hr	TPY	lb/hr	TPY
FUGITIVE EMISSIONS				
Stockpile Emissions	0.26	1.13	0.06	0.28
Unpaved Haulroad Emissions	43.62	191.04	13.08	57.31
Paved Haulroad Emissions	0.00	0.00	0.00	0.00
Fugitive Emissions Total	**43.87**	**192.17**	**13.15**	**57.59**
POINT SOURCE EMISSIONS				
Equipment Emissions	5.64	24.70	0.06	0.25
Transfer Point Emissions	1.04	4.55	0.84	3.69
Point Source Emissions Total*	**6.68**	**29.25**	**0.90**	**3.94**
Facility Emissions Total	**50.55**	**221.42**	**14.05**	**61.53**

*Note: Point Source Total Controlled PM-10 TPY emissions is used for 45CSR30 Major Source determination

1. *Emissions From CRUSHING AND SCREENING*

1a. Primary Crushing

Primary Crusher ID Number	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1b. Secondary and Tertiary Crushing

Secondary & Tertiary Crusher ID	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1c. Screening

Screen ID Number	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
SS-01	12.000	52.560	0.120	0.526	5.640	24.703	0.056	0.247
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	12.000	52.560	0.120	0.526	5.640	24.703	0.056	0.247

Crushing and Screening	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
TOTAL	12.000	52.560	0.120	0.526	5.640	24.703	0.056	0.247

1. Emissions From CRUSHING AND SCREENING (Continued)

EMISSION FACTORS

source: Air Pollution Engineering Manual and References

(lb/ton of material throughput)

PM	
Primary Crushing	0.02
Tertiary Crushing	0.06
Screening	0.1

PM-10	
Primary Crushing	0.0094
Tertiary Crushing	0.0282
Screening	0.047

2. *Emissions From TRANSFER POINTS*

Transfer Point ID No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
TP01	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP02	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP03	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP04	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP05	0.122	0.534	0.001	0.005	0.058	0.253	0.001	0.003
TP06	0.122	0.534	0.024	0.107	0.058	0.253	0.012	0.051
TP07	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP08	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP09	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP10	0.122	0.534	0.024	0.107	0.058	0.253	0.012	0.051
TP11	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP12	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP13	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP14	0.122	0.534	0.024	0.107	0.058	0.253	0.012	0.051
TP15	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP16	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP17	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
TP-18	0.122	0.534	0.122	0.534	0.058	0.253	0.058	0.253
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2. *Emissions From TRANSFER POINTS (continued)*

Transfer Point ID No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTALS	2.196	9.620	1.783	7.808	1.039	4.550	0.843	3.693

Source:
AP42, Fifth Edition, Revised 11/2006
13.2.4 Aggregate Handling and Storage Piles

Emissions From Batch Drop

E = k*(0.0032) * [(U/5)^1.3]/[(M/2)^1.4] = pounds/ton

Where:

		PM	PM-10
k =	Particle Size Multiplier (dimensionless)	0.74	0.35
U =	Mean Wind Speed (mph)		
M =	Material Moisture Content (%)		

Assumptions:

k - Particle size multiplier
For PM (< or equal to 30um) k = 0.74
For PM-10 (< or equal to 10um) k = 0.35

Emission Factor
For PM E= $I$88*(0.0032)*((((Inputs!$I$72)/5)^1.3)/(((Inputs!G78+0.000000001)/2)^1.4)
=lb/ton

For PM-10 E= $J$88*(0.0032)*((((Inputs!$I$72)/5)^1.3)/(((Inputs!G78+0.000000001)/2)^1.4
=lb/ton

For lb/hr [lb/ton]*[ton/hr] = [lb/hr]

For Tons/year [lb/ton]*[ton/yr]*[ton/2000lb] = [ton/yr]

3. *Emissions From WIND EROSION OF STOCKPILES*

Stockpile ID No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
OS-01	0.249	1.089	0.062	0.272	0.117	0.512	0.029	0.128
OS-02	0.121	0.529	0.030	0.132	0.057	0.248	0.014	0.062
OS-03	0.121	0.529	0.030	0.132	0.057	0.248	0.014	0.062
OS-04	0.057	0.248	0.014	0.062	0.027	0.117	0.007	0.029
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTALS	0.547	2.395	0.137	0.599	0.257	1.126	0.064	0.281

Source:
Air Pollution Engineering Manual

Storage Pile Wind Erosion (Active Storage)

E = 1.7*[s/1.5]*[(365-p)/235]*[f/15] = (lb/day/acre)

Where:

s =	silt content of material
p =	number of days with >0.01 inch of precipitation per year
f =	percentage of time that the unobstructed wind speed
	exceeds 12 mph at the mean pile height

Emission Factors

For PM E=(1.7)*((Inputs!F147)/1.5)*((365-Inputs!I139)/235)*((Inputs!I140)/15)

For PM-10 E=0.47*(1.7)*((Inputs!F147)/1.5)*((365-Inputs!I139)/235)*((Inputs!I140)/15)

For lb/hr [lb/day/acre]*[day/24hr]*[base area of pile (acres)] = lb/hr

For Ton/yr [lb/day/acre]*[365day/yr]*[Ton/2000lb]*[base area of pile (acres)] = Ton/yr

4. Emissions From UNPAVED HAULROADS

Item No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
1	15.42	67.56	4.63	20.27	4.46	19.52	1.34	5.86
2	45.16	197.82	13.55	59.35	13.05	57.17	3.92	17.15
3	45.16	197.82	13.55	59.35	13.05	57.17	3.92	17.15
4	45.16	197.82	13.55	59.35	13.05	57.17	3.92	17.15
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	150.92	661.02	45.28	198.31	43.62	191.04	13.08	57.31

Source:
AP42, Fifth Edition, Revised 11/2006
13.2.2 Unpaved Roads

Emission Estimate For Unpaved Haulroads at Industrial Sites (equation 1)

E= k*((s/12)^a)*((W/3)^b) =lb/vmt

Where:

		PM	PM-10
k =	particle size multiplier	4.90	1.50
a =	empirical constant	0.7	0.9
b =	empirical constant	0.45	0.45

Emission Factors
For PM E= (($I$35)*(((Inputs!$I$163)/12)^($I$36))*(((Inputs!H171)/3)^$I$37))

For PM-10 E= (($J$35)*(((Inputs!$I$163)/12)^($J$36))*(((Inputs!H171)/3)^$J$37))

For lb/hr (lb/vmt)*(miles per trip)*(Max trips per hour)

For Ton/yr (lb/vmt)*(miles per trip)*(Max trips per year)*(1/2000)

5. Emissions From INDUSTRIAL PAVED HAULROADS

Item No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source:
AP42, Fifth Edition, Revised 11/2006
13.2.1 PAVED ROADS

Emission Estimate For Paved Haulroads

E = [k * (sL/2)^0.65 * (W/3)^1.5 - C] * (1 - (P/4*N) = lb / Vehicle Mile Traveled (VMT)

Where:

		PM	PM-10
k =	particle size multiplier	0.082	0.016
sL =	road surface silt loading, (g/ft^2)	1	
P =	number of days per year with precipitation >0.01 inch	157	
N =	number of days in averaging period	365	
C=	factor for exhaust, brake wear and tire wear	0.0047	0.0047

Emission Factors

For PM E= ($I$34*((($I$35)/2)^0.65)*(((Inputs!G190)/3)^1.5)-($I$38))*(1-((Inputs!I

For PM-10 E= ($J$34)*((($I$35)/2)^0.65)*(((Inputs!G190)/3)^1.5))-($I$38))*(1-((Inputs!$

For lb/hr (lb/vmt)*(miles per trip)*(Max trips per hour)

For Ton/yr (lb/vmt)*(miles per trip)*(Max trips per year)*(1/2000)

Attachment O

MONITORING OF OPERATIONS

For the purposes of determining compliance with maximum throughput limits, the applicant shall maintain certified daily and monthly records with example forms included as Appendix A . An example form for tracking the amount of water applied through the water truck is included as Appendix B. The Certification Of Data Accuracy statement shall be completed within fifteen (15) days of the end of the reporting period. These records shall be maintained on site by the permittee for at least five (5) years and shall be made available to the Director of the Division of Air Quality or his or her duly authorized representative upon request.

The owner or operator of an open storage pile, which includes the equipment used in the loading, unloading, and conveying operations of the affected facility, constructed, reconstructed, or modified after May 27, 2009, must prepare and operate in accordance with a submitted fugitive coal dust emissions control plan that is appropriate for the site conditions. The fugitive coal dust emissions control plan must identify and describe the control measures the owner or operator will use to minimize fugitive coal dust emissions from each open storage pile. The plan must be submitted to the Director prior to startup of the new, reconstructed or modified open storage pile.

This facility will employ the use of a water truck with pumps and pressure sufficient to control the release of fugitive emissions from stockpiles.

Legal Advertisement

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that Everett Energy, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a Reg. 13 Permit Application for a screening and material separation facility located on Powdermill Branch, near Fort Gay in Wayne County, West Virginia. The facility coordinates are as follows: latitude 38.046004 and longitude –82.515275.

The applicant estimates the potential to discharge the following Regulated Air Pollutants will be: particulate matter baseline emissions of 8 tons per year, point source emissions particulate matter less than 10 microns total of 4 tons per year, and the controlled facility emission total of 207 tons per year. The applicant estimates the potential to discharge the following uncontrolled Criteria Air Pollutants from the use of generators will be: NOx 17.438 tons per year, CO 3.758 tons per year, VOC 1.389 tons per year, SO2 1.153 tons per year, PM10 1.238 tons per year. The applicant estimates the potential to discharge the following uncontrolled Hazardous Air Pollutants will be: Benzene 0.002187 tons per year, Butadiene 9.16E-05, Toluene 0.000959 tons per year, Xylenes 0.000668 tons per year, Acetaldehyde 0.001798 tons per year, Formaldehyde 0.002766 tons per year, Acrolein 0.000217 tons per year, Naphthalene 0.000199 tons per year.

Startup of operation is planned to begin upon permit approval. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1227, during normal business hours.

Dated this the 24th day of April 2015

By: Everett Energy, LLC
Paul McCoy
Managing Member
PO Box 211
Pikeville, KY 41502

<u>TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS</u>

Other than particulate matter and particulate matter less than 10 microns in diameter, which are non-toxic pollutants, the only non criteria regulated pollutants that are addressed by this permit application are the very small amount of Hazardous Air Pollutants that are the normal byproduct of diesel combustion.

Acetaldehyde:

Acetaldehyde is mainly used as an intermediate in the synthesis of other chemicals. It is ubiquitous in the environment and may be formed in the body from the breakdown of ethanol. Acute (short-term) exposure to acetaldehyde results in effects including irritation of the eyes, skin, and respiratory tract. Symptoms of chronic (long-term) intoxication of acetaldehyde resemble those of alcoholism. Acetaldehyde is considered a probable human carcinogen (Group B2) based on inadequate human cancer studies and animal studies that have shown nasal tumors in rats and laryngeal tumors in hamsters.

Acrolein:

Acrolein is primarily used as an intermediate in the synthesis of acrylic acid and as a biocide. It may be formed from the breakdown of certain pollutants in outdoor air or from the burning of organic matter including tobacco, or fuels such as gasoline or oil. It is toxic to humans following inhalation, oral or dermal exposures. Acute (short-term) inhalation exposure may result in upper respiratory tract irritation and congestion. No information is available on its reproductive, developmental, or carcinogenic effects in humans, and the existing animal cancer data are considered inadequate to make a determination that acrolein is carcinogenic to humans.

Benzene:

Benzene is found in the air from emissions from burning coal and oil, gasoline service stations, and motor vehicle exhaust. Acute (short-term) inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as a Group A, human carcinogen.

Formaldehyde:

Formaldehyde is used mainly to produce resins used in particle board products and as an intermediate in the synthesis of other chemicals. Exposure to formaldehyde may occur by breathing contaminated indoor air, tobacco smoke, or ambient urban air. Acute (short-term) and chronic (long-term) inhalation exposure to formaldehyde in humans can result in respiratory symptoms, and eye, nose, and throat irritation. Limited human studies have reported an association between formaldehyde exposure and lung and nasopharyngeal cancer. Animal inhalation studies have reported an increased incidence of nasal squamous cell cancer. EPA considers formaldehyde a probable human carcinogen (Group B1).

Naphthalene:

Naphthalene is used in the production of phthalic anhydride; it is also used in mothballs. Acute (short-term) exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and neurological damage. Cataracts have also been reported in workers acutely exposed to naphthalene by inhalation and ingestion. Chronic (long-term) exposure of workers and rodents to naphthalene has been reported to cause cataracts and damage to the retina. Hemolytic anemia has been reported in infants born to mothers who "sniffed" and ingested naphthalene (as mothballs) during pregnancy. Available data are inadequate to establish a causal relationship between exposure to naphthalene and cancer in humans. EPA has classified naphthalene as a Group C, possible human carcinogen.

Toluene:

The acute toxicity of toluene is low. Toluene may cause eye, skin, and respiratory tract irritation. Short-term exposure to high concentrations of toluene (e.g., 600 ppm) may produce fatigue, dizziness, headaches, loss of coordination, nausea, and stupor; 10,000 ppm may cause death from respiratory failure. Ingestion of toluene may cause nausea and vomiting and central nervous system depression. `Contact of liquid toluene with the eyes causes temporary irritation. Toluene is a skin irritant and may cause redness and pain when trapped beneath clothing or shoes; prolonged or repeated contact with toluene may result in dry and cracked skin. Because of its odor and irritant effects, toluene is regarded as having good warning properties. The chronic effects of exposure to toluene are much less severe than those of benzene. No carcinogenic effects were reported in animal studies. Equivocal results were obtained in studies to determine developmental effects in animals. Toluene was not observed to be mutagenic in standard studies.

Xylene:

Commercial or mixed xylene usually contains about 40-65% m-xylene and up to 20% each of o-xylene and p-xylene and ethyl benzene. Xylenes are released into the atmosphere as fugitive emissions from industrial sources, from auto exhaust, and through volatilization from their use as solvents. Acute (short-term) inhalation exposure to mixed xylenes in humans results in irritation of the eyes, nose, and throat, gastrointestinal effects, eye irritation, and neurological effects. Chronic (long-term) inhalation exposure of humans to mixed xylenes results primarily in central nervous system (CNS) effects, such as headache, dizziness, fatigue, tremors, and incoordination; respiratory, cardiovascular, and kidney effects have also been reported. EPA has classified mixed xylenes as a Group D, not classifiable as to human carcinogenicity.

ENGINE DATA SHEET

Source Identification Number[1]		Gen Set					
Engine Manufacturer and Model		Caterpillar					
Manufacturer's Rated bhp/rpm		450					
Source Status[2]		NS					
Date Installed/Modified/Removed (Month/Year)[3]		2015					
Engine Manufactured/Reconstruction Date[4]		2014					
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart IIII? (Yes or No)[5]		Yes					
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart JJJJ? (Yes or No)[6]							
Engine, Fuel and Combustion Data	Engine Type[7]	LB4S					
	APCD Type[8]	A/F					
	Fuel Type[9]	#2FO					
	H_2S (gr/100 scf)						
	Operating bhp/rpm	1800					
	BSFC (Btu/bhp-hr)	128700					
	Fuel throughput (ft^3/hr)	13.9 GAL					
	Fuel throughput ($MMft^3$/yr)	34750					
	Operation (hrs/yr)	2500					
Reference[10]	Potential Emissions[11]	lbs/hr	tons/yr			lbs/hr	tons/yr
	NO_X	13.9500	17.438				
	CO	3.0060	3.758				
	VOC	1.1115	1.389				
	SO_2	0.9225	1.153				
	PM_{10}	0.9900	1.238				
	Formaldehyde	0.00221	0.002766				

1. Enter the appropriate Source Identification Number for each reciprocating internal combustion compressor/generator engine located at the facility. Multiple compressor engines should be designated CE-1, CE-2, CE-3 etc. Emergency Generator engines should be designated EG-1, EG-2, EG-3 etc. If more than three (3) engines exist, please use additional sheets.

2. Enter the Source Status using the following codes:

NS	Construction of New Source (installation)	ES	Existing Source
MS	Modification of Existing Source	RS	Removal of Source

3. Enter the date (or anticipated date) of the engine's installation (construction of source), modification or removal.

4. Enter the date that the engine was manufactured, modified or reconstructed.

5. Is the engine a certified stationary compression ignition internal combustion engine according to 40CFR60 Subpart IIII. If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance according to 40CFR§60.4210 as appropriate.

   Provide a manufacturer's data sheet for all engines being registered.

6. Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart JJJJ. If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance according to 40CFR§60.4243a(2)(i) through (iii), as appropriate.

   Provide a manufacturer's data sheet for all engines being registered.

7. Enter the Engine Type designation(s) using the following codes:

LB2S	Lean Burn Two Stroke	RB4S	Rich Burn Four Stroke
LB4S	Lean Burn Four Stroke		

8. Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:

A/F	Air/Fuel Ratio	IR	Ignition Retard
HEIS	High Energy Ignition System	SIPC	Screw-in Precombustion Chambers
PSC	Prestratified Charge	LEC	Low Emission Combustion
NSCR	Rich Burn & Non-Selective Catalytic Reduction	SCR	Lean Burn & Selective Catalytic Reduction

9. Enter the Fuel Type using the following codes:

PQ	Pipeline Quality Natural Gas	RG	Raw Natural Gas
2FO	#2 Fuel Oil	LPG	Liquid Propane Gas

10. Enter the Potential Emissions Data Reference designation using the following codes. Attach all referenced data to this *Compressor/Generator Data Sheet(s)*.

MD	Manufacturer's Data	AP	AP-42
GR	GRI-HAPCalc™	OT	Other ________________ (please list)

11. Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall be calculated at manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control Devices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the *Emissions Summary Sheet*.

STORAGE TANK DATA SHEET

Source ID #[1]	Status[2]	Content[3]	Volume[4]	Dia[5]	Throughput[6]	Orientation[7]	Liquid Height[8]
T1	NEW	#2FO	2,000	5'	70,000	HORZ	4'

1. Enter the appropriate Source Identification Numbers (Source ID #) for each storage tank located at the facility. Tanks should be designated T01, T02, T03, etc.
2. Enter storage tank Status using the following:

   EXIST Existing Equipment   NEW Installation of New Equipment
   REM Equipment Removed
3. Enter storage tank content such as condensate, pipeline liquids, glycol (DEG or TEG), lube oil, etc.
4. Enter storage tank volume in gallons.
5. Enter storage tank diameter in feet.
6. Enter storage tank throughput in gallons per year.
7. Enter storage tank orientation using the following:

   VERT Vertical Tank   HORZ Horizontal Tank
8. Enter storage tank average liquid height in feet.

EMISSION SUMMARY SHEET FOR CRITERIA POLLUTANTS

						Registration Number (Agency Use) Pending				
	Potential Emissions (lbs/hr)					Potential Emissions (tons/yr)				
Source ID No.	NO_X	CO	VOC	SO_2	PM_{10}	NO_X	CO	VOC	SO_2	PM_{10}
GEN1	13.9500	3.0060	1.1115	0.9225	0.9900	17.438	3.758	1.389	1.153	1.238
Total	13.9500	3.0060	1.1115	0.9225	0.9900	17.438	3.758	1.389	1.153	1.238

EMISSION SUMMARY SHEET FOR HAZARDOUS/TOXIC POLLUTANTS

							Registration Number (Agency Use) Pending					
	Potential Emissions (lbs/hr)						Potential Emissions (tons/yr)					
Source ID No.	Benzene	Butadiene	Toluene	Xylenes	Acetakdehyde	Formalde-hyde	Benzene	Butadiene	Toluene	Xylenes	Acetakdehyde	Formalde-hyde
GEN1	0.00175	7.3E-05	0.00077	0.00053	0.00144	0.00221	0.002187	9.16E-05	0.000959	0.000668	0.001798	0.002766
Source ID No.	Acrolein	Naphthalene					Acrolein	Naphthalene				
GEN1	0.00017	0.00016					0.000217	0.000199				
Total HAP	0.00711 LB/HOUR	0.008884 TPY										

CRUSHING AND SCREENING AFFECTED SOURCE SHEET

Source Identification Number[1]		SS-01				
Type of Crusher or Screen[2]		TD				
Date of Manufacture[3]		2015				
Maximum Throughput[4]	tons/hour	120				
	tons/year	1,051,200				
Material sized from/to:[5]		4x0				
Average Moisture Content (%)[6]		5				
Control Device ID Number[7]		FE				
Baghouse Stack Parameters[8]	height (ft)	N/A				
	diameter (ft)					
	volume (ACFM)					
	exit temp (°F)					
	UTM Coordinates					
Maximum Operating Schedule[9]	hours/day	24				
	days/year	365				
	hours/year	8760				
Percentage of Operation[10]	January-March	25				
	April-June	25				
	July-September	25				
	Oct-December	25				

1. Enter the appropriate Source Identification Number for each crusher and screen. For example, in the case of an operation which incorporates multiple crushers, the crushers should be designated CR-1, CR-2, CR-3 etc. beginning with the breaker or primary crusher. Multiple screens should be designated S-1, S-2, S-3 etc.

2. Describe types of crushers and screens using the following codes:

   HM Hammermill
   DR Double Roll Crusher
   BM Ball Mill
   RB Rotary Breaker
   JC Jaw Crusher
   GC Gyratory Crusher
   OT Other

   SS Stationary Screen
   SD Single Deck Screen
   DD Double-Deck Screen
   TD Triple Deck Screen
   OT Other

3. Enter the date that each crusher and screen was manufactured.

4. Enter the maximum throughput for each crusher and screen in tons per hour and tons per year.

5. Describe the nominal material size reduction (e.g. +2"/ -_").

6. Enter the average percent moisture content of the material processed.

7. Enter the appropriate Control Device Identification Number for each crusher and screen. Refer to Table A - *Control Device Listing* and *Control Device Identification Number Instructions* in the *Reference Document* for Control Device ID prefixes and numbering.

8. Enter the appropriate stack parameters if a baghouse control device is used.

9. Enter the maximum operating schedule for each crusher and screen in hours per day, days per year and hours per year.

10. Enter the estimated percentage of operation throughout the year for each crusher and screen.

CONVEYING AFFECTED SOURCE SHEET

Source Identification Number[1]	Date of Manufacture[2]	Type of Material Handled[3]	Size of Material Handled[4]	Maximum Material Transfer Rate[5]		Average Moisture Content (%)[6]	Control Device[7]
				tons/hour	tons/year		
BC-01	2015	RC	4x0	120	1,051,200	5	NC
BC-02	2015	Reject	4x0	120	1,051,200	5	NC
BC-03	2015	Reject	4x0	120	1,051,200	5	NC
BC-04	2015	RC	2x0	120	1,051,200	5	NC
BC-05	2015	RC	2x0	120	1,051,200	5	NC
BC-06	2015	RC	>1x0	120	1,051,200	5	NC
BC-07	2015	RC	>1x0	120	1,051,200	5	NC

STORAGE ACTIVITY AFFECTED SOURCE SHEET

Source Identification Number[1]	BS-01	BS-02				
Type of Material Stored[2]	RC	RC				
Average Moisture Content (%)[3]	5	5				
Maximum Yearly Storage Throughput (tons)[4]	1,051,200	1,051,200				
Maximum Storage Capacity (tons)[5]	10	5				
Maximum Base Area (ft^2)[6]	N/A	N/A				
Maximum Pile Height (ft)[7]						
Method of Material Load-in[8]	FE	SS				
Load-in Control Device Identification Number[9]	UD-MDH	TC-MDH				
Storage Control Device Identification Number[9]	PE	PE				
Method of Material Load-out[8]	SS	Chute				
Load-out Control Device Identification Number[9]	TC-MDH	TC-FE				

1. Enter the appropriate Source Identification Number for each storage activity using the following codes. For example, if the facility utilizes three storage bins, four open stockpiles and one storage building (full enclosure), the Source Identification Numbers should be BS-1, BS-2, and BS-3; OS-1, OS-2, OS-3, and OS-4; and SB-1, respectively.
   - BS Bin or Storage Silo (full enclosure)
   - OS Open Stockpile
   - SF Stockpiles with wind fences
   - E3 Enclosure (three sided enclosure)
   - SB Storage Building (full enclosure)
   - OT Other :

2. Describe the type of material stored or stockpiled (e.g. clean coal, raw coal, refuse, etc).

3. Enter the average percent moisture content of the stored material.

4. Enter the maximum yearly storage throughput for each storage activity.

5. Enter the maximum storage capacity for each storage activity in tons (e.g. silo capacity, maximum stockpile size, etc.)

6. For stockpiles, enter the maximum stockpile base area.

7. For stockpiles, enter the maximum stockpile height.

8. Enter the method of load-in or load-out to/from stockpiles or bins using the following codes:
   - CS Clamshell
   - FC Fixed Height Chute from Bins
   - FE Front Endloader
   - MC Mobile Conveyor/Stacker
   - UC Under-pile or Under-Bin Reclaim Conveyor
   - RC Rake or Bucket Reclaim Conveyor
   - SS Stationary Conveyor/Stacker
   - ST Stacking Tube
   - TC Telescoping Chute from Bins
   - TD Truck Dump
   - PC Pneumatic Conveyor/Stacker
   - OT Other: Fabric Vent Filter

STORAGE ACTIVITY AFFECTED SOURCE SHEET

Source Identification Number[1]	OS-01	OS-02	OS-03	OS-04	
Type of Material Stored[2]	RC	RC	RC	Reject	
Average Moisture Content (%)[3]	5	5	5	5	
Maximum Yearly Storage Throughput (tons)[4]	1,051,200	1,051,200	1,051,200	1,051,200	
Maximum Storage Capacity (tons)[5]	25,000	10,000	10,000	5,000	
Maximum Base Area (ft^2)[6]	38,869	18,869	18,869	8,869	
Maximum Pile Height (ft)[7]	50	40	40	40	
Method of Material Load-in[8]	TD	SS	SS	SS	
Load-in Control Device Identification Number[9]	UL-MDH	TC-MDH	TC-MDH	TC-MDH	
Storage Control Device Identification Number[9]	SW-WS	SW-WS	SW-WS	SW-WS	
Method of Material Load-out[8]	FE	FE	FE	FE	
Load-out Control Device Identification Number[9]	UD-MDH	LO-MDH	LO-MDH	LO-MDH	

****Water for control of stockpile emission will be supplied by the water truck that is equipped with pumps and sprays sufficient to control fugitive emissions.**

FGX DRY COAL PROCESSING

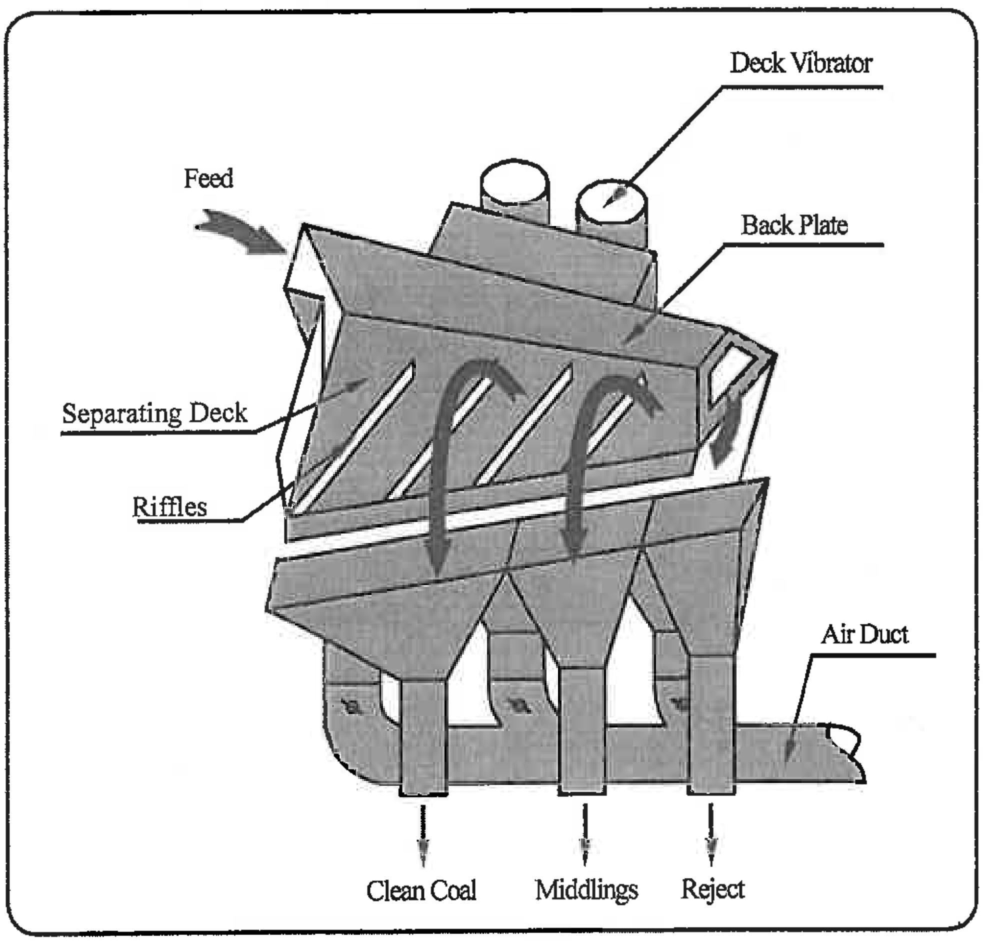
FGX SEPTECH, LLC

Tangshan Shenzhou Manufacturing Group, Co. Ltd.

FGX DRY COAL PROCESSING

Usually coal is cleaned using water. Billions of gallons of water is used every year for coal cleaning. With water becoming an ever-so vital and precious resource, dry coal cleaning has drawn attention in all major coal producing areas of the world.

The FGX technology provides an innovative and cost-effective dry coal processing process that integrates the separation principles of an autogenous medium separator and a conventional table concentrator. Three product streams including deshaled product, middlings and tailing streams are obtained through this process. Two dust collection mechanisms are employed, making the technology environmentally friendly.



Schematic of the FGX Dry Coal Separator

FEATURES OF THE FGX SEPARATOR

- A completely dry process
- Simple process and high separation efficiency
- Environmental friendly and cost effective
- Easy to set up and operate
- Low maintenance
- Easy permitting

TYPICAL APPLICATIONS

- Steam coal deshaling
- Deshaling of metallurgical coal
- Pit cleaning/rib coal recovery
- Gob pile processing
- Dry separation of high sulfur coal
- On-site processing of high wall mining coal
- Processing of blast furnace injection coal
- Coal prep in arid regions
- Processing of low-rank coal, e.g. lignite
- Destoning of coal in utilities and cement plants

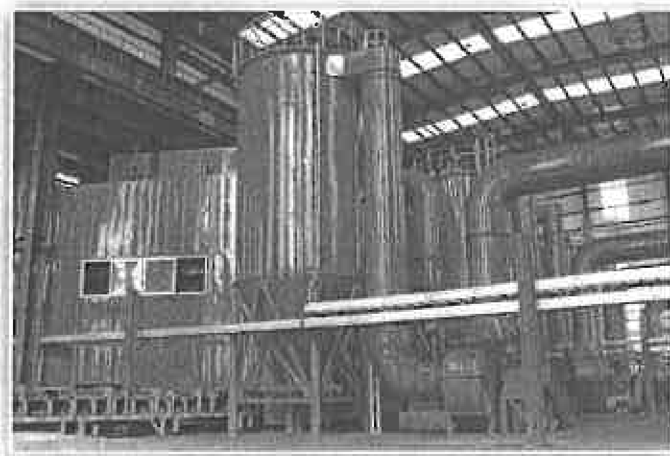
During the last decade dry coal processing has been growing exponentially due to the continued technical improvements and increasing environmental concerns. As the world's leading dry coal processing solutions provider, FGX has a proven track record of helping coal operators significantly increase operational efficiency and profitability. A series of FGX separators are available including FGX-48A model which has a processing capacity of 480 tons/hour on a single unit, the largest dry coal separator in the world.

PRODUCT CATALOG

MODEL	CAPACITY tph	DIMENSIONS ft,in [m], l×w×h	POWER hp[kW]
FGX-1	~10	18'8"×10'2"×19'8" [5.7×3.1×6.0]	32.3[24.12]
FGX-2	~20	24'11"×22'8"×22' [7.6×6.9×6.7]	80.4[59.99]
FGX-3	~30	30'2"×27'3"×28'7" [9.2×8.3×8.7]	98.9[73.75]
FGX-6	~60	37'5"×35'1"×30'6" [11.4×10.7×9.3]	195.3[145.65]
FGX-9	~90	42'3"×39'5"×31'2" [12.9×12.0×9.5]	368.0[274.4]
FGX-12	~120	46'7"×43'4"×31'6" [14.2×13.2×9.6]	441.9[329.5]
FGX-18A	~180	61'5"×46'8"×31'2" [18.7×14.2×9.5]	736.0[548.8]
FGX-24A	~240	75'7"×48'2"×31'6" [23.1×14.7×9.6]	883.7[659.0]
FGX-24	~240	62'8"×47'8"×38'6" [19.1×14.5×11.7]	870.8[649.34]
FGX-48A	~480	83'5"×68'6"×38'6" [25.4×20.9×11.7]	1741.6[1298.68]

NOTES: 1. The raw coal can be loosed in the seperating deck as the requirement of the raw coal moisture.
2. Feed size for FGX-1 and FGX-2 is 2.5 in. (60 mm) to 0; for all other models is 3 in. (80 mm) to 0.
3. Models with "A" are dual systems, e.g., an FGX-18A consists of two FGX-9 units.
4. Horse power does not include auxiliary equipment such as conveyor belts, etc.
5. Specifications subject to change without notice.

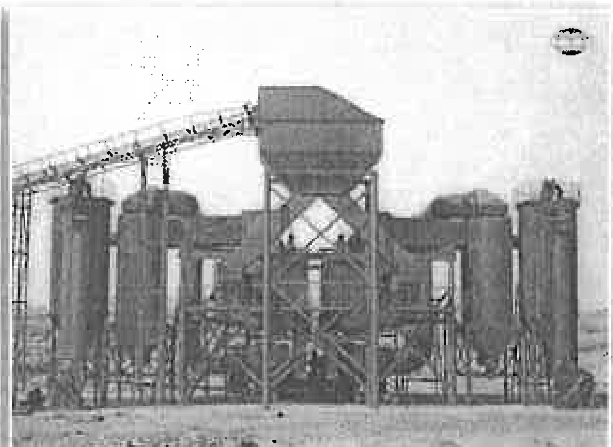
FGX PHOTO GALLERY



1400 tph FGX Plant
(Shenhua Energy)

480 tph FGX Plant

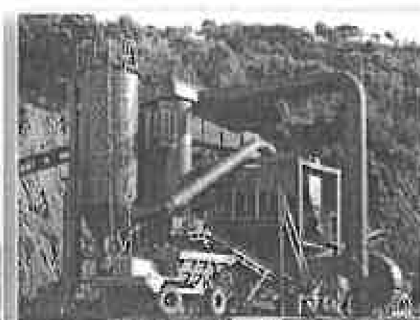
240 tph FGX Plant



180 tph FGX Plant

120 tph FGX Plant

90 tph FGX Plant

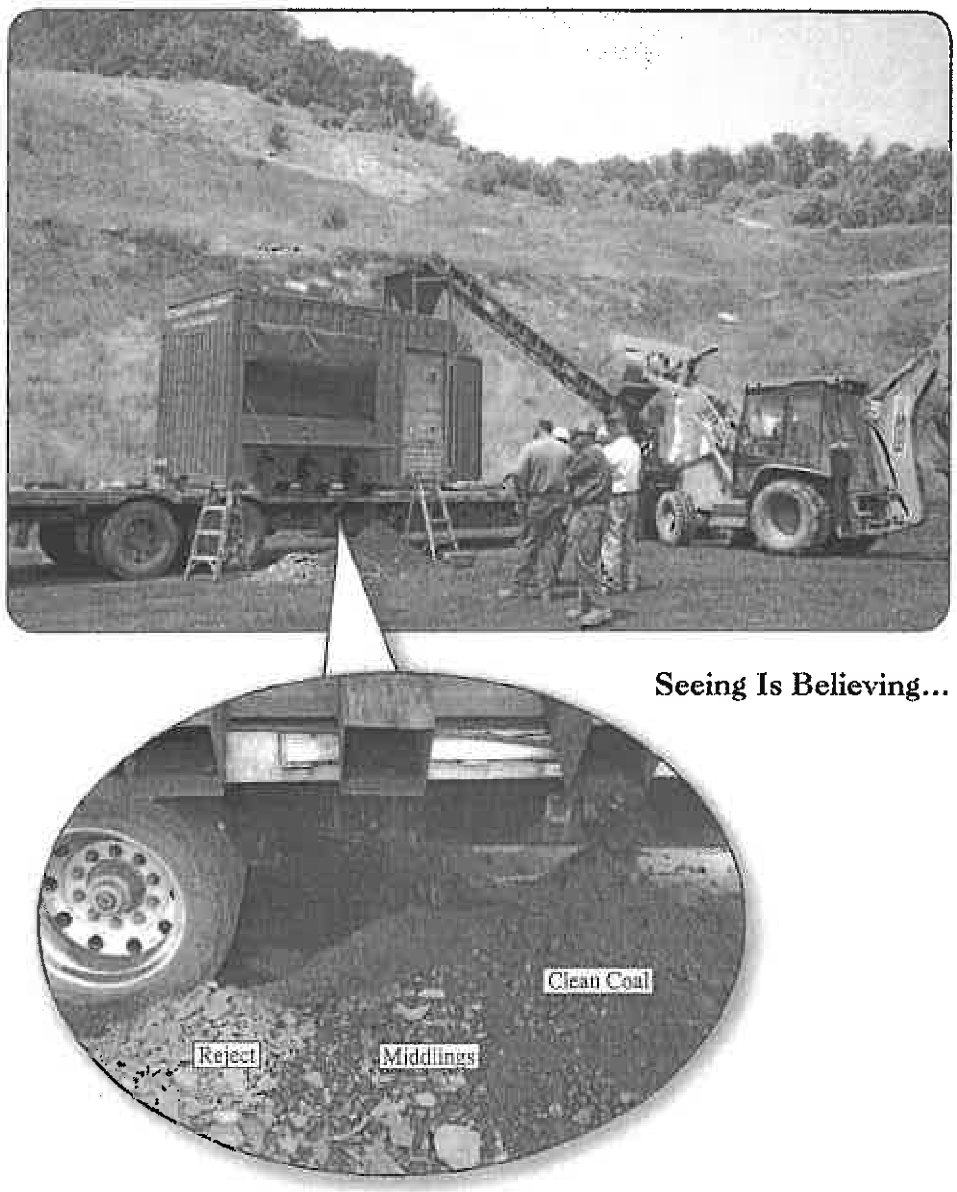


60 tph FGX Plant

FEASIBILITY STUDY

Wondering if FGX is the right process for your coal prep needs?

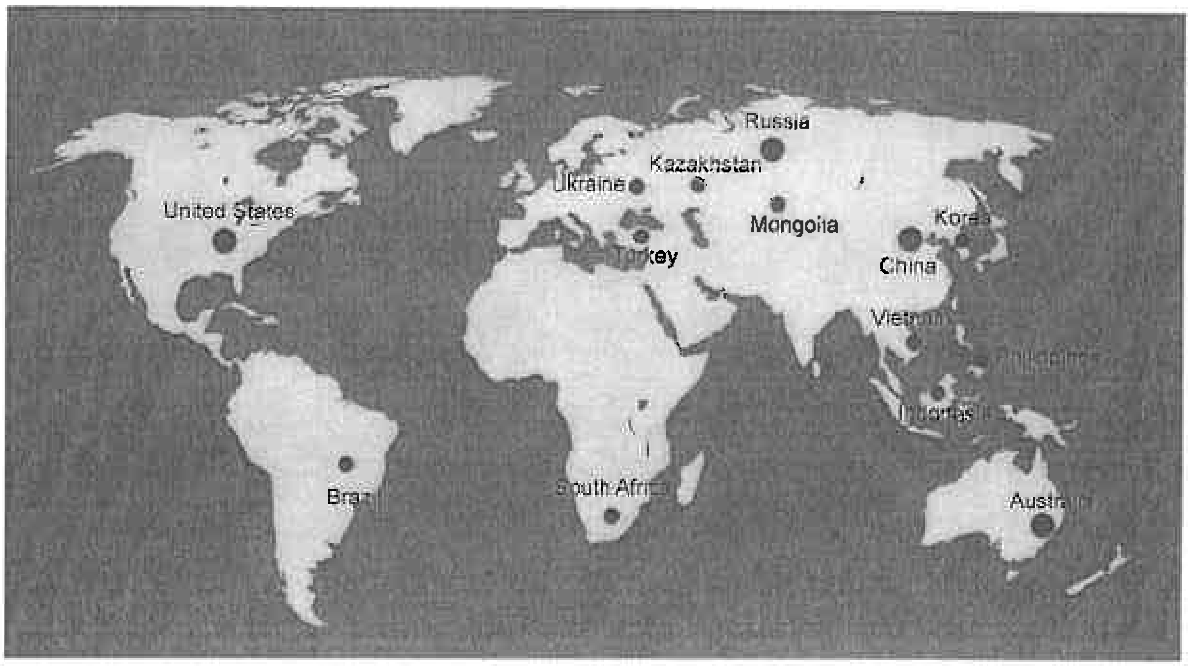
Please provide us with the particle size analysis and washability information of your coal, and we will inform you if dry coal processing is suitable for your application. We can also bring our mobile pilot-scale test unit to your site to run your coal.



Seeing Is Believing...

FGX GOES WORLDWIDE

More than 1,500 of our award-winning FGX dry coal separators have been applied in Brazil, China, Indonesia, Korea, Kazakhstan, Mongolia, Philippines, Russia, South Africa, Turkey, Ukraine and Vietnam, etc.



ABOUT US

FGX SepTech, LLC, incorporated in Lexington, Kentucky, is the sole supplier of FGX series dry coal separators in America. The FGX dry coal processing is a proprietary dry coal processing technology developed by Tangshan Shenzhou Manufacturing, Co. Ltd (TSM), headquartered in Tangshan, Hebei Province, China.

TSM was founded in 1996 by Mr. Gongmin Li and it has grown from a small machine shop into a top coal preparation equipment manufacturer in China. FGX SepTech and TSM are committed to becoming the worldwide leading dry coal processing solutions provider through focusing on customer satisfaction and technical excellence.

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V. 2011-10

FINAL TECHNICAL REPORT

Project Title:

DEVELOPMENT OF AN ADVANCED DESHALING TECHNOLOGY TO IMPROVE THE ENERGY EFFICIENCY OF COAL HANDLING, PROCESSING, AND UTILIZATION OPERATIONS

U. S. Department of Energy
Industrial Technologies Program, Mining of the Future
ID Number: DE-FC26-05NT42501

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Project Team

University of Kentucky
Virginia Tech
Peabody Energy
Massey Energy
Eriez Manufacturing

Project Period: May 1, 2005 – April 30, 2007

DISCLAIMER

EXECUTIVE SUMMARY

The concept of using a dry, density-based separator to achieve efficient, near-face rock removal, commonly referred to as deshaling, was evaluated in several applications across the U.S.. Varying amounts of high-density rock exist in most run-of-mine feed. In the central Appalachian coalfields, a rock content exceeding 50% in the feed to a preparation plant is commonplace due to high amounts of out-of-seam dilution made necessary by extracting coal from thin seams. In the western U.S, an increase in out-of-seam dilution and environmental regulations associated with combustion emissions have resulted in a need to clean low rank coals and dry cleaning may be the only option.

A 5 ton/hr mobile deshaling unit incorporating a density-based, air-table technology commercially known as the FGX Separator has been evaluated at mine sites located within the states of Utah, Wyoming, Texas, West Virginia, Virginia, Pennsylvania and Kentucky. The FGX technology utilizes table riffling principles with air as the medium. Air enters through the table and creates a fluidized bed of particles comprised of mostly fine, high density particles. The high density particle bed lifts the low-density coal particles to the top of the bed. The low-density coal moves toward the front of the table due to mass action and the downward slope of the table. The high-density particles settle through the fluidized particle bed and, upon making contact with the table, moves toward the back of the table with the assistance of table vibration. As a result, the low-density coal particles exit the front of the table closest to the feed whereas the high-density, high-ash content particles leave on the side and front of the table located at the farthest from the feed entry.

At each test site, the run-of-mine feed was either directly fed to the FGX unit or pre-screened to remove the majority of the -6mm material. The surface moisture of the feed must be maintained below 9%. Pre-screening is required when the surface moisture of the feed coal exceeds the maximum limit. However, the content of -6mm in the feed to the FGX separator should be maintained between 10% and 20% to ensure an adequate fluidized bed.

A parametric evaluation was conducted using a 3-level experimental design at each test site to identify the optimum separation performance and parameter values. The test data was used to develop empirical expressions that describe the response variables (i.e., mass yield and product ash content) as a function of the operating parameter values. From this process, it was established that table frequency and longitudinal slope are the most critical factors in controlling both mass yield and clean coal ash while the cross table slope was the least significant. Fan blower frequency is a critical parameter that controls mass yield. Although the splitter positions between product and middling streams and the middling and tailing streams were held constant during the tests, a separate evaluation indicated that performance is sensitive to splitter position within certain lengths of the table and insensitive in others.

For a Utah bituminous coal, the FGX separator provided clean coal ash contents that ranged from a low of 8.57% to a high of 12.48% from a feed coal containing around 17% ash. From the 29 tests involved in the statistically designed test program, the average clean coal ash content was 10.76% while the tailings ash content averaged around 72%. One of the best separation performances achieved an ash reduction from 17.36% to 10.67% while recovering 85.9% of the

total feed mass, which equated to an ash rejection value of around 47%. The total sulfur content was typically decreased from 1.61% to 1.49%. These performances were quantified by blending the middlings stream with the clean coal product.

At a second Utah site, coal sources from three different bituminous coal seams were treated by the FGX deshaling unit. Three parameter values were varied based on the results obtained from Site No. 1 to obtain the optimum results shown in Table E-1. Approximately 9 tests were performed on each coal source. The average ash content reductions were: Glenwal (= 25.6% to 8.6%), Pinnacle (=17.3% to 9.0%) and Westridge (=20.6% to 7.5%). Under optimum conditions, nearly 70% of the high-density rock was rejected while recovering approximately 100% of the 1.60 float material.

In the Powder River Basin, a small portion of the extracted coal is mistakenly diluted with out-of-seam rock. Since coal cleaning is not currently practiced, the diluted coal containing 20%-30% ash is left in the pit as fill material, thereby representing a lost resource. A FGX test program conducted on the high ash sub-bituminous coal revealed the ability to produce clean coal containing 7% - 8% ash on a dry basis (5% - 6% on an as-received basis) with 62% recovery. The product grade meets typical end user contract specifications for PRB coal.

In Texas, lignite is used to generate a majority of the electric production and, in some locations, the coal contains elevated amounts of sulfur in the form of pyrite. A series of tests revealed that the FGX separator has the ability of reducing the total sulfur content by over 40% and the mercury content by as much as 67%. Energy recovery was nearly 90%. As a result of these findings, the construction of a full-scale 600 tph dry cleaning facility was commissioned and production started in 2008.

Several coal sources were tested in the eastern U.S. with the objective of maximizing rock rejection while ensuring nearly 100% energy recovery. For a Virginia mining operation, the FGX unit rejected 33.5% of the feed coal that contained 88% ash bearing material. Considering a 15 mile haul from the mine to the preparation plant at a cost of $0.30/ton*mile, a 450 ton/hr operation could save $4 million annually in transportation costs. At a West Virginia mine, the coal is transported by rail haulage to a wet coal cleaning facility. FGX tests produced a reject containing 0.78% of 1.6RD float material representing 36.4% of the total feed. An economic analysis considered the savings in reduced transportation as well as the costs of the lost coal and operating the dry cleaner. The findings indicate the potential to gain $4.6 million annually from a 500 tph operation. A 17% reduction in energy use was estimated by employing dry separation technology at the mine site, which also reduces the amount of impact land and reduces the size of slurry impoundments.

Coal recovery from coarse coal waste generated from past mining operations was also evaluated at two sites. In general, the FGX separator recovered +6mm coal containing between 30% and 35% ash. The heating value was upgraded from around 6000 Btu/lb to 10,000 Btu/lb while recovering 45% of the feed material in the +6mm size fraction. The quality of the material recovered from coarse gob has sufficient value to be used as blend coal in the utility market.

TABLE OF CONTENTS

1.0 BACKGROUND

Deshaling is the process of removing high density rock from coal. In contrast to the coal cleaning in traditional preparation plants, the separation density is higher with a typical target of 2.0 relative density or greater. An additional objective is to place the deshaling unit as close to the extraction face as possible to reduce transportation and maintenance costs. The concept was the focus of an extensive study in the 1980's which led to the development of the wet, density-based Humboldt ROMJIG (Sanders et al., 2000; Sanders and Ziaja, 2003). Current interest is to identify an efficient and cost-effective dry cleaning technology for the purpose of achieving the deshaling objective.

Recent studies have indicated significant technical and economical benefits for deshaling coals in a number of different situations (Luttrell et al., 1996; Honaker et al., 2004), i.e.,

i. Removing high density rock from a steam coal that is not being processed through a preparation plant in an effort to improve heating value.

ii. Reducing rock content from run-of-mine coal prior to loading and transportation. In the Central Appalachia coalfields in the U.S., coal is being extracted with 60% - 70% reject due to out of seam dilution and transported 20 – 30 miles to the preparation plant. This situation is an ideal application for deshaling.

iii. Eliminating rock from coal that is not treated and blended with a processed coal to achieve a product having the required quality. The studies have shown that the use of deshaling on the untreated coal to remove one ton of rock will allow the recovery of three additional tons of middling material currently rejected during the processing of the treated coal.

The economics of deshaling for steam coal applications are understood on the basis of an improved heating value and the fact that utilities pay on the basis of $/MMBtu rather than $/ton. Consider a situation where a coal with a heating value of 12500 Btu/lb is worth $50/ton. The total heating value for the coal is 25 MMBtu (= 1 ton x 2000 lb/ton x 12,500 Btu/lb). As such, the monetary value of the coal is $2 per MMBtu (= $50/25 MMBtu). Thus, improving the heating value through deshaling provides the potential to significantly improve revenue.

As a result of eliminating the transportation, handling and storage of material having no heating value, it is estimated that an annual energy savings of nearly 270 trillion btu units can be realized using deshaling units at U. S. coal mining operation.

1.1 Deshaling Technologies

Interest in dry coal cleaning has increased significantly in recent years mainly due to a need to clean lignite and sub-bituminous coals in the western and Gulf Coast regions of the U.S.. Expectations are that requirements for cleaning Powder River Basin coal will increase in the near future due to changing geological conditions that include the presence of intrusions in some of the major coal seams. An additional application is the removal of high density rock from run-of-mine coal in the Central Appalachia coalfields prior to shipment to a processing facility. The economics of mining the thin coals seams in this region requires the extraction of a large amount of out-of-seam material which commonly has resulted in low plant yield values in the range of 35%- 50%. Honaker et al. (2006) also showed that the treatment of low ash run-of-mine coal to remove the small amount of rock using a dry separator prior to blending with washed coal has significant economical benefits.

Dry particle separators have a long history of application in the U.S. coal industry. According to Arnold et al. (1991), the amount of coal processed in the U.S. through dry cleaning plants reached a peak in 1965 at 25.4 million tons. The largest dry-based cleaning plant located in Pennsylvania processed 1400 tph of minus 3/4-in coal using a total of 14 units. The last complete dry cleaning plant operating in Kentucky was closed in the late 1980's. Reasons for the decline in dry coal production to less than 4 million tons annually by 1990 include increased run-of-mine moisture levels that resulted from dust suppression requirements and the demand for higher quality, compliance coal which required efficient, low density separations.

Several of the dry, density-based separators used throughout the twentieth century were developed in the period from 1910 to 1930 (Osborne, 1988). The technologies incorporated the same basic principle mechanisms that are commonly employed in wet cleaning separators including: 1) dense medium separations, 2) pulsated air jigging, 3) riffled table concentration and 4) air fluidized coal launders whereby the coal is fluidized into the top layers of a particle bed and subsequently skimmed off.

The effective top size particle for most of the separators was around 2-in and the effective size ratio for which good separation was achieved was between 2:1 and 4:1. It is noted that this effective particle size range is much smaller than most wet, density based separators. The reported probable error (E_p) values vary due to the particle size ranges treated. For example, within a small particle size range of 4:1, the E_p values ranged from 0.15 – 0.25 whereas a 50:1 ratio provides values around 0.30. These values indicate that the air-based systems are much inferior in separation efficiency as compared to wet coarse coal cleaning units. However, dry coal cleaning devices typically have lower capitol and operating costs, no waste water treatment and impoundment requirements, lower product moisture values and less permitting requirements. If a high density separation provides the desired effect on coal quality, dry cleaning separators are an attractive option.

Several processing technologies used during the peak years of dry coal preparation have been recently modified and successfully commercialized. The Allair Jig, for example, is a modification of the Stomp Jig technology and is commercially represented by Alminerals Ltd. (Kelly and Snoby, 2002). The unit has been successful applied in several applications within and outside the U.S. for coal cleaning (Weinstein and Snoby, 2007). Chinese researchers and manufacturers have applied basic fundamentals including computational fluid dynamics to the redesign of dry particle separators including those employing dense medium and tabling principles. The FGX separator is an example of a Chinese dry, density-based separation technology that has several hundred commercial installations (Lu et al., 2003, Li and Yang, 2006).

1.2 FGX Separator

The FGX dry cleaning system employs the separation principles of an autogenous medium and a table concentrator. As shown in Figure 1, the feed to the system is introduced into a surge bend from which the underflow is controlled using an electro-magnetic feeder. The separation process generates three products, i.e., deshaled product, middlings and tailing streams. Two dust collection systems are employed to clean the recycled air and to remove the dust from air being emitted into the atmosphere. The separating compartment consists of a deck, vibrator, air chamber and hanging mechanism (Figure 2a). A centrifugal fan provides air that passes through holes on the deck surface at a rate sufficient to transport and fluidize the particles. Riffles located on the deck direct material toward the back plate. The deck width is reduced from the feed end to the final refuse discharge end. Upon introduction of the feed coal into the separation chamber, a particle bed of certain thickness is formed on the deck. The particles near the bottom of the bed directly contact the vibrating deck and move from the discharge baffle plate toward the back plate under the effect of the vibration-induced inertia force. Upon striking the back plate, the particles move upward and inward toward the discharge side of the table (Figure 2b). Light particles are lifted up the back plate at a higher elevation than the dense particles before turning inward toward the discharge point. As such, light particles create the upper layer of particles that are collected along the length of the table. Particles of sufficient density are able to settle through the autogenous medium formed due to the fluidized bed of particles and report back to the deck surface. These heavy particles are forced by both vibration and the continuous influx of new feed material to transport in a helical transport pattern toward the narrowing end of the table where the final refuse is collected.

Performance data for the FGX separator is currently limited to tests on Chinese coals and a few pilot-scale tests on U.S. coals. However, the separation data collected to date indicates that this system offers an attractive and cost-effective alternative to traditional coal preparation processes, particularly for green-field sites where coal cleaning operations are being utilized for the first time (e.g., India). The data obtained from studies conducted in China indicate that the unit has the potential to provide an effective separation for particles as coarse as 80 mm (3 inches) to a lower size limit of around 3 mm (0.1 inches). The operational data also indicate that the process is relatively insensitive to surface moisture up to a value of about 7-10% by weight. As shown in Table 1, the FGX unit has the ability to provide a relatively high separation density (RD_{50}) of around 2.0 RD while achieving probable error (Ep) values that range from 0.15 to 0.25 (Lu et al., 2003). This level of performance provides high organic efficiencies approaching 97%. The capital cost for a 250 t/hr unit was reported to be less than one fourth that of a traditional preparation plant design with operating costs below US$0.30 per tonne.

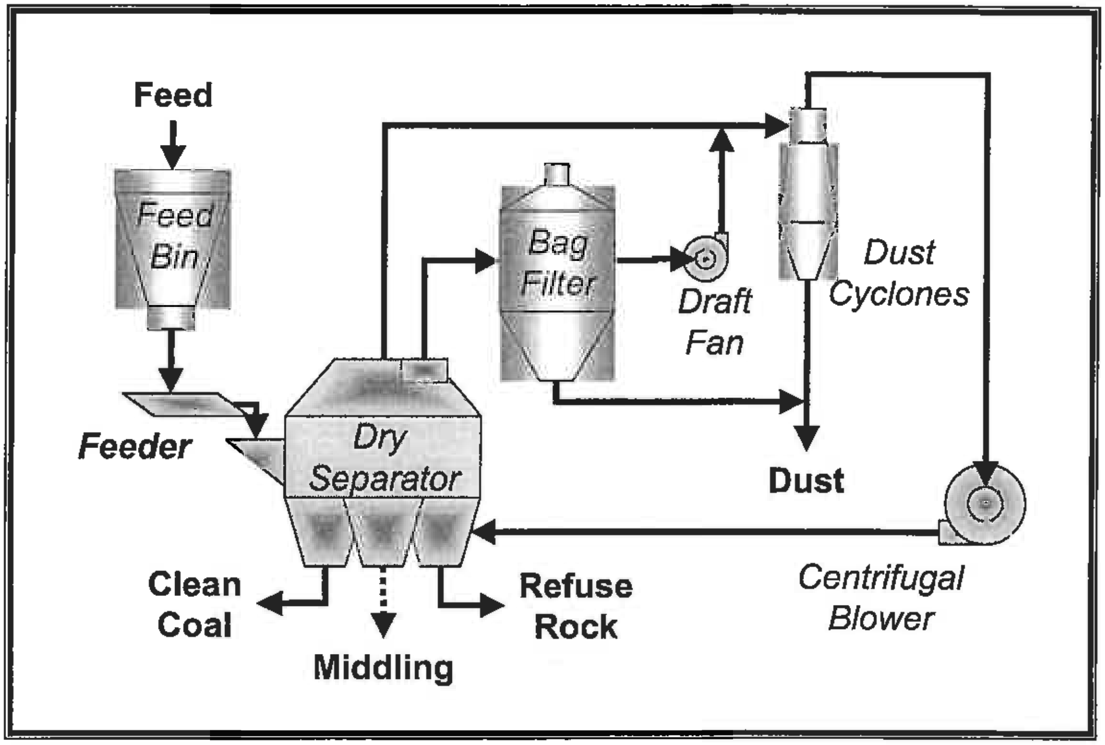


Figure 1. Simplified process flowsheet for the FGX air table separator system.

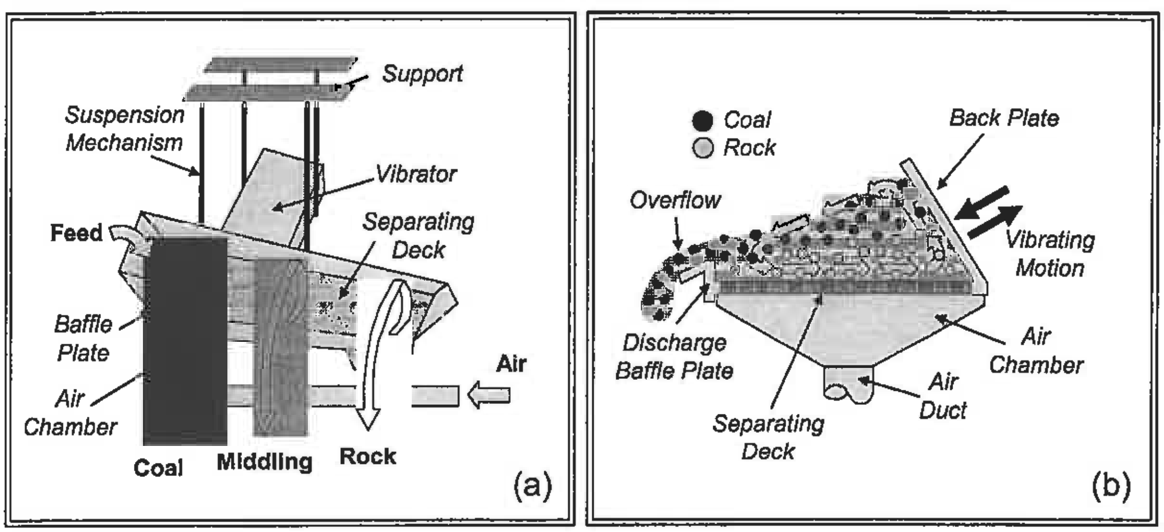


Figure 2. Illustrations of the FGX unit showing (a) the separation chamber and (b) helical particle motion and separation mechanism.

Table 1. Performance data for the FGX separator for different Chinese coals (50 x 6 mm).

Efficiency Parameter	Mine A	Mine B	Mine C
Separation Density (RD_{50})	2.12	1.98	1.82
Probable Error (E_P)	0.23	0.15	0.25
Organic Efficiency (%)	96.96	96.65	---

2.0 PROJECT GOALS AND OBJECTIVES

The goal of the project was to significantly enhance the energy efficiency and economics of transporting, processing and utilizing coal by employing a novel, dry deshaling technology near the extraction point of surface mining operations. The pilot-scale FGX unit was mobilized and tested at numerous sites across the U.S. for the treatment of all ranks of coal. Test programs were conducted in Utah (bituminous coal), Texas (lignite coal), Wyoming (sub-bituminous coal), Virginia (bituminous coal), West Virginia (bituminous coal), Pennsylvania (anthracite) and Kentucky (bituminous coal). Test programs were also conducted on coarse gob material to assess the potential of using the FGX separator to recover coal from waste generated from previous coal processing activities.

Success in various degrees was realized at each test site. For example, the treatment of Powder River Basin coal focused on the recovery of coal from material that is currently left in the mine face area due to dilution with out of seam material. A product ash content of around 8.4% on a dry basis was obtained from the waste material using the FGX unit at a recovery of 90%. The treatment of Gulf Coast lignite resulted in 40% total sulfur reduction and 60% mercury reduction. This performance resulted in a decision to install a full-scale dry coal cleaning facility using the FGX separator to clean the coarse particle size fraction. In the eastern U.S., several test programs demonstrated the ability of the FGX separator to remove 30% to 50% of the run-of-mine coal. The rejected material contained more than 70% ash with little heating value. By removing the material, the total amount of material requiring transportation to a coal cleaning plant, processed and subsequently transported to an above-ground storage facility was significantly reduced.

The project objectives and accomplishments are compared in Table 2. Most of the project objectives were successfully achieved. However, the total project funding received was approximately 60% of the awarded amount. As a result, project tasks focused on developing an on-line process efficiency system for dry cleaning and expanding the particle size range that can be cleaned by the FGX unit was not addressed. The project accomplishments exceeded the total funding received.

Table 2. Project objectives and accomplishments.

Project Objectives		Project Accomplishments
1. Optimize the operating and physical parameters to provide efficient high density separations while achieving 100% total energy recovery.		1. A 5-tph dry cleaning unit was evaluated at several mining operations across the U.S. using statistically designed test program. The results were used to identify the optimum separation performance and the set of parameter values.
2. A significant enhancement of energy efficiency due to reducing the need to haul, process and store pure rock		2. The dry cleaning unit was found to have the ability to reject 30% - 50% material containing little to no heating value. As a result, significant energy savings will be obtained from the reduction of material transported, processed and stored. Energy savings are estimated to be 9 million kwh/year which represents a 17% reduction for a 2.95 million ton operation.
3. Improvement in mining economics through the replacement of pure rock in the product with a threefold weight increase in the recovery of middling particles		3. Significant rejections of pure rock was obtained in several test programs conducted on all ranks of coal across the U.S.. By installing a units at the mine site, economic savings can be realized from reduced transportation, handling and processing. For a typical operation, the economic savings was estimated to be $4.6 million annually.
4. Reduction in the environmental impact of mining and utilizing coal		4. In nearly every case except for the Powder River Basin and Gulf Coast coals, 30% - 50% of the feed was rejected by the dry cleaner as high ash material. This material can be kept at the mine and used as fill material rather than placed into above-land storage facilities. Dry cleaning is the only option for low rank coals and the FGX unit demonstrated the ability to significantly reduce ash, total sulfur and mercury. A full-scale FGX unit was recently installed for this purpose for the cleaning of lignite.
5. Employ the use of tracers for on-line efficiency evaluations in a dry density-based separations		5. Not accomplished due to reduced funding.
6. Increase the effective particle size range that can be treated.		6. Not accomplished due to reduced funding.

3.0 GENERAL EXPERIMENTAL METHODOLOGY

A 5 tph pilot scale FGX Separator unit utilizing a 1 m^2 air table was used at the various test sites. The feed to the unit was supplied directly from the mine or pre-screened to remove the -6mm material from the feed prior to treatment. Underground coal sources required pre-screening due to the relatively large amount of fines and the amount of surface water present due to dust suppression activities. Feed coal was fed to the bin shown in Figure 3 by a conveyor or front-end loader. Feed from the feed bin was controlled using a vibratory feeder and transferred via a conveyor belt to a hopper that feeds an internal screw conveyor. The screw conveyor feeds an internal hopper subsequently feeds the back right corner of the table (Figure 4).

Figure 3. On-site test set-up using the 5 tph FGX pilot-scale air table.

Upon entry of the feed onto the table deck, the upward flow of air creates a fluidized-bed of fine reject which causes the light coal particles to migrate to the top of the particle bed. The coal moves toward the right front part of the table due to the downward slope of the table (e.g., typical slope is 8^{O} downward from the back of the table to the front). The high-density particles ride on the table surface which is vibrated at a preset frequency. The vibration drives the high-density particles to the back of the table where the particles are forced by mass action to travel toward the left side of the table.

The particles that overflow the front of the table are directed into product, middling or tailing bins by splitters that are adjusted to achieve a clean coal product and a high-ash content tailings. The material in each of the three bins is transferred by conveyor away from the FGX unit.

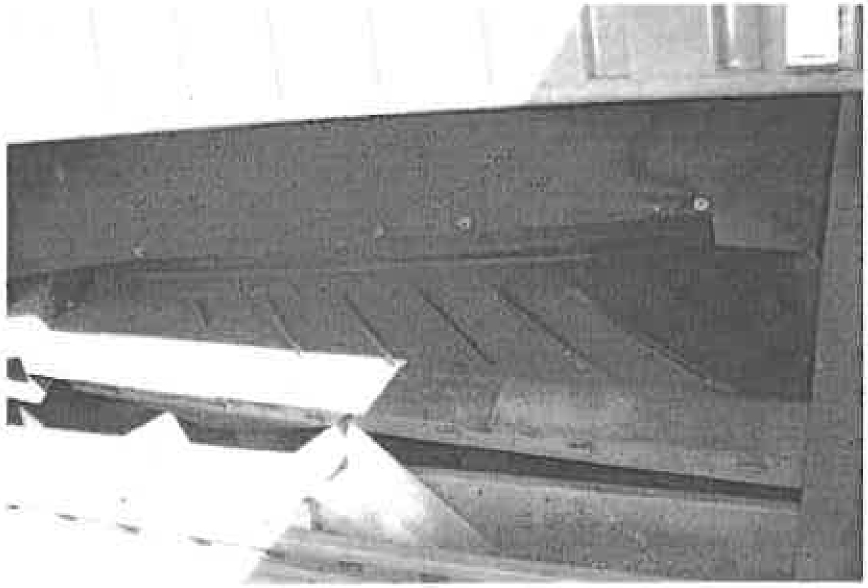


Figure 4. Deck (1 m^2) of the FGX air table.

With the exception of tests performed on coarse reject material, a three-level statistically-designed test program was performed on each run-of-mine coal to determine if the magnitude of the parametric effects vary as a function of coal rank and the amount of reject material in the feed. Four operating variables were evaluated at the first test site including fluidization air rate, table frequency, longitudinal table slope and cross-table slope. The total number of tests was 28. After the first test program, the cross-table slope was kept at a constant value thereby resulting in a reduction in the number of tests to 15. By varying the parameter values systematically, the optimum test performances and the corresponding conditions were identified.

The sampling program used two different approaches. The first approach involved collecting representative samples from the product, middling and tailing streams with established splitter positions. The second approach utilized a specially designed collection device that divided the material exiting the edge of the table into six different splits. The splits were 18 inches apart which allowed the quality of the material exiting the table to be evaluated as a function of table length.

4.0 PROJECT ACCOMPLISHMENTS

4.1 Western U.S. Coal Test Progam

4.1.1 Utah Bituminous Coal

The deshaling system was transported and setup at two mining operations in Utah that treated bituminous coal. A representative sample of the feed from the first site was analyzed to determine the particle size-by-size and density-by-density weight and quality distributions. As shown in Table 3, the majority of the ash-forming components existed in the +1/4-in material. As such, the feed was prescreened using a ¼-inch screen and the overflow directed to the feed bin of the FGX unit. The washability data indicated potential to achieve a significant reduction in the ash content by achieving a high density separation in the FGX unit. A product containing less than 10% ash can be realized as a result of a density separation at a cutpoint of 2.0.

Table 3. Characterization data obtained from analysis of the run-of-mine bituminous coal at Mine Site No. 1.

Size Fraction (mm)	Particle Size Analysis			Specific Gravity Fraction	Washability Analysis		
	Weight (%)	Ash (%)	Total Sulfur (%)		Weight (%)	Ash (%)	Total Sulfur (%)
50 x 25	12.85	31.62	1.63	1.4 Float	75.06	6.25	1.85
25 x 12.7	34.71	19.90	1.69	1.4 x 1.6	8.61	21.32	1.63
12.7 x 6.3	41.97	15.62	1.67	1.6 x 1.8	2.42	37.12	2.85
- 6.3	10.47	11.81	4.19	1.8 x 2.0	1.44	53.24	3.79
				2.0 x 2.2	1.84	71.40	3.11
				2.2 Sink	10.63	87.10	2.12
Total	100.00	18.76	1.93	Total	100.00	18.76	1.93

The second site in Utah was at an Andalex mining operation that produced coal from three different coal seams. Five different coal sources were evaluated. Each coal source was screened to obtain 50 x 9mm material to feed the FGX unit.

Parameter Evaluation & Optimization

At test site No. 1, the test program conducted on the FGX pilot-scale unit was performed using a Box-Behnken test design to evaluate and optimize the values of four operating parameters that were identified as being the most critical. The amplitude of the table was maintained at 8 mm while the air valve supplying air to the table was set at the full open position. The parameters and parameters values used in each test are provided in Table 4. Feed rate was maintained at a level of around 5.6 tons/hr (5.0 metric tons/hr). The tests were conducted in continuous mode with no recycling of the middling stream. Mass yield values were determined based on the middlings stream being combined with the tailings stream to represent the total reject.

Table 4. Parameters and value levels evaluated in the Box-Behnken test program.

Operating Parameter	Parameter Value Levels		
	Low	Middle	High
Air Blower (hz)	50	55	60
Table Frequency (hz)	40	45	50
Cross-Table Slope (degrees)	8.0	8.5	9.0
Longitudinal Slope (degrees)	0.5	1.0	1.5

At site No. 2 (Andalex), the test program conducted on the FGX pilot-scale unit was performed by changing three parameters that were identified as being the most critical based on the earlier findings at test site No. 1. The tests were conducted in continuous mode with no recycling of the middling stream. The parameters and parameters values used in each test are provided in Table 5. Feed rate was maintained at a level of around 5.6 tons/hr (5.0 metric tons/hr) while the values of the other operating parameters were kept at the levels provided in Table 6. All analytical data are presented on an air-dried basis in this report.

Table 5. Parameters and parameter values evaluated in the FGX test program (Site 2, Andalex).

Test Number	Air Blower (hz.)	Table Frequency (hz.)	Cross Table Slope (degree)	Longitudinal Slope (degree)
1	55	45	8.5	1.0
2	55	40	8.5	1.5
3	55	40	8.5	0.5
4	60	45	8.5	1.5
5	60	45	8.5	0.5
6	60	40	8.5	1.0
7	50	45	8.5	1.5
8	60	40	8.5	0.5

Table 6. Parameter values maintained constant during FGX test program (Site 2, Andalex).

Parameter	Position A	Position B	Position C
Air Valve Setting	Full Open	Full Open	Full Open
Front Gate Position (mm)	32 - 45	7 - 32	0 - 18
Splitter Position	1	3	
Amplitude (mm)		8	
Reject Door		Closed	

Results and Discussion

Separation Performance (Utah Site 1): The average ash reduction achieved during the test program by the FGX unit was from 18.21% to 10.76% while recovering 76.8% of the total feed weight. The total sulfur content was decreased from 1.61% to 1.49%. This equates to ash and total sulfur rejection values of 53.9% and 29.0% on average, respectively. As a result, the average heating value of the coal was upgraded from 11513 Btu/lb to 12691 btu/lb. Product ash and total sulfur contents realized from the FGX unit were as low as 9.55% and 1.39%, respectively, with minimal effect on overall product yield.

The average ash content in the tailings stream was 72.70% and values greater than 80% were realized from several tests. Also, sulfur was found to be effectively concentrated into the tailings stream as indicated by an average sulfur content of 2.67%.

The separation performances on the basis of ash reduction are compared with +1/4-inch washability data in Figure 5. A high level of efficiency was achieved when producing a clean coal products containing greater than 10.5% ash. As the product ash decreased beyond this value, organic efficiency (=actual recovery/washability recovery) decreased significantly. The main reason for this trend is that the middlings and tailings stream data were combined as total FGX refuse for yield and recovery calculations. The middling stream material contained 29.62% ash on average and represented about 14% of the total feed flow rate. This data indicates that a significant amount of clean coal and pure rock remains in the middling stream and thus needs to be recycled to the primary feed stream to recover the misplaced coal. If one assumes that clean coal containing 10% ash product and a tailings material containing 75% ash could be recovered from the middlings stream represented by the average ash content from the 29 tests, secondary treatment of the middlings has the potential to provide an increase in yield of nearly 10 absolute percentage points above the average performance, which equates to a mass yield of 86.8%.

The results from four of the best performances achieved over a range in product ash contents are summarized in Table 7. The results show:

1. The FGX has the ability to reduce ash content to values below 12% while maintaining a high level of recovery.

2. Rock is effectively rejected into the tailings stream without losing coal as indicated by the high tailings ash.

3. The middlings stream requires retreatment to recover misplaced, low-density coal.

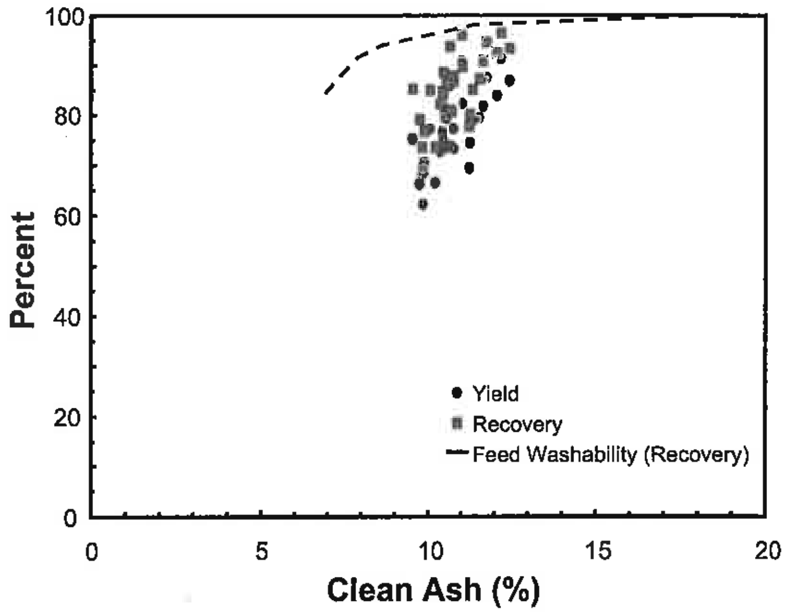


Figure 5. Comparison of the FGX separation performances with +1/4-in washability data.

Table 7. Optimum separation performances achieved from the 29 parameter evaluation tests.

Test	Feed Ash (%)	Product Ash (%)	Middlings Ash (%)	Tailings Ash (%)	Product Yield (%)
1	19.10	9.55	23.56	70.24	75.2
2	17.36	10.67	47.24	77.67	85.9
3	15.62	11.03	59.02	80.42	90.8
4	16.38	12.23	58.23	80.63	91.4

Parametric Evaluation (Site 1): The data from the statistically-designed test program were used to develop empirical models describing mass yield and clean coal ash content as a function of the operating parameter values. Both models successfully passed the model and 'lack-of-fit' tests that are associated with ANOVA analyses. The R^2 and adjusted R^2 values for the yield model were 0.848 and 0.806, respectively, which indicates a reasonably good fit to the experimental results within the parameter value ranges tested. The ash model is adequate with corresponding R^2 values of 0.710 and 0.613.

The form of the models is:

$$Y = A_1 + A_2(ABF) + A_3(TF) + A_4(CTS) + A_5(LS) + A_6(ABF^2) + ... + A_i(CTS \times LS) \quad [1]$$

where Y is the response variable (either yield or product ash), A_i the corresponding coefficients, *ABF* the air blower frequency, *TF* the table frequency, *CTS* the cross-table slope and *LS* the longitudinal slope. Based on a significance test of each parameter in the model, the model for each response parameter was reduced to include only the significant terms. The coefficients for each model term are provided in Table 8. All possible parameter interactions (e.g., TF x CTS) were evaluated. The most important parameters for both yield and clean coal ash were table frequency and longitudinal slope. The cross table slope had the least effect and was borderline significant for both yield and product ash. Unexpectedly, air blower frequency had no statistically significant effect on product ash content.

Within the range of operating parameter values tested, the optimum separation performance and corresponding conditions as defined by maximizing yield and minimizing clean coal ash content are provided in Table 9. The fact that the optimum conditions correspond to the maximum air blower frequency and longitudinal slope tested in this program indicates that potential exists for improved performance outside the upper value limits.

Table 8. Yield and clean coal ash model coefficients.

Model Terms	Mass Yield Coefficients A_i	Clean Coal Ash Coefficients A_i
Intercept	-367.95	237.12
ABF	0.57	---
TF	-18.40	-2.20
CTS	198.29	-40.81
LS	10.66	-12.08
TF^2	0.19	0.02
CTS^2	-11.58	2.34
LS^2	---	-1.48
CTS x *LS*	---	1.89

Table 9. Optimum operating conditions and separation performance.

Air Blower (hz.)	Table Frequency (hz.)	Cross Table Slope (degree)	Log. Slope (degree)	Clean Coal Ash (%)	Mass Yield (%)
60	42.5	8.3	1.5	10.19	86.13

The separation performance can also be controlled by the splitter positions which are positioned to separate the product, middlings and tailings streams. A study was performed to quantify the distribution of the ash-bearing material across the length of the deck as shown in Figure 6. From Table 10, it is clear that the ash content and wt% of the coal exiting the FGX deck varies significantly throughout the entire length of the table. The data suggests that relatively clean coal reports in positions 1 through 3 while high density reject material reports to positions 5 and 6 under the given loading conditions. The material in position 4 is comprised of mixed-phase particles as well as misplaced low-density and high-density material. Figure 4 cumulates the mass yield reporting to the product stream and the ash content from the clean coal end to the tailings end. Under the conditions described above, a clean coal product containing about 10% ash can be produced while recovering 78% of the total feed mass. The mass yield can be significantly increased if the middlings fraction is recycled to the feed stream for re-processing.

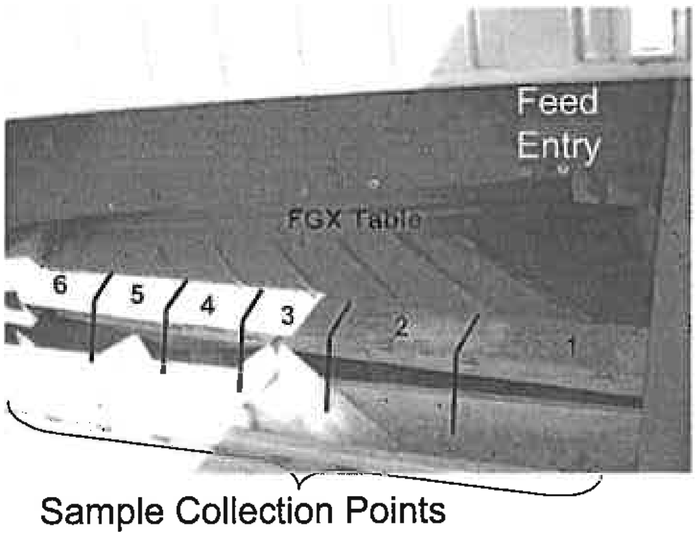
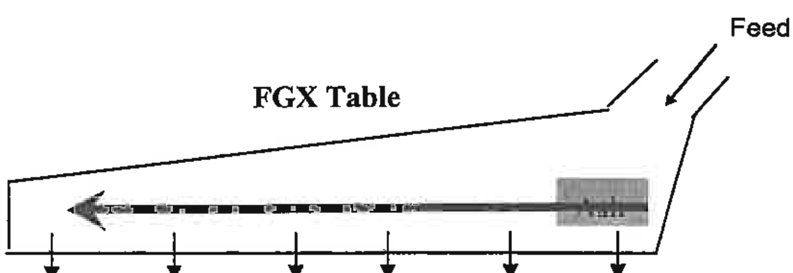


Figure 6. The sample collection points through out the deck of the FGX separator.



Sample No.	6	5	4	3	2	1
Weight %	1.60	11.66	8.33	11.66	30.00	36.66
Ash %	79.41	80.46	58.33	15.68	10.57	9.53
sulfur %	0.36	0.62	0.46	0.61	0.56	0.47
Btu	1212	850	5527	12371	13111	13290

Table 10. Distribution of ash-bearing material across the length of the air table.

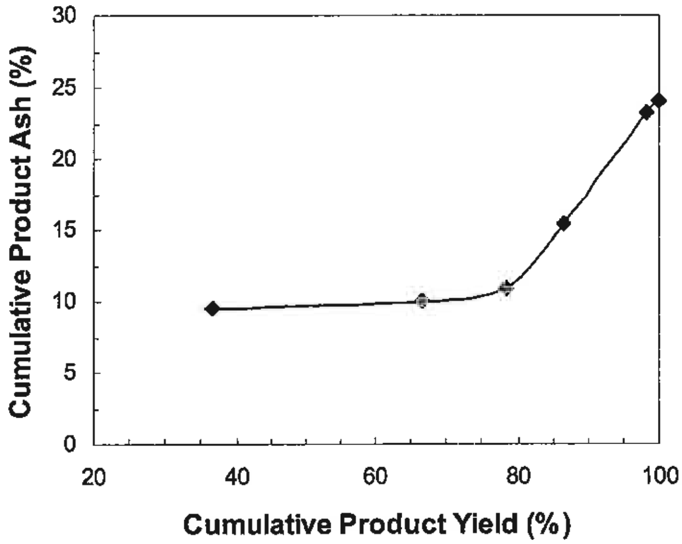


Figure 7. Separation performance as a function of splitter position.

Separation Performance (Utah Site 2): Westridge Coal Seam: The Westridge coal proved to be a challenging sample for the FGX separator because of its low feed ash content. Over the entire test program, the average ash reduction achieved by the FGX unit was from 9.92% to 6.02% while recovering 57.22% of the total feed weight (Table 11). This equates to ash rejection values of 64.03% on average. The overall total sulfur content (1.27%) did not decrease because in this sample, sulfur exists mainly in organic form. As a result, the average heating value of the coal was upgraded from 13443 Btu/lb to 14063 Btu/lb. The optimal energy recovery realized from the FGX unit was 69% which corresponds to a mass yield of 65.5% and a product ash content of 5.94%. The low yield and energy recovery values are a result of a significant amount of high quality coal that reported to the middlings stream.

Table 11. Separation performance data achieved for the Westridge coal sample; air-dried basis.

Test No.	Ash Content (%)				Total Sulfur (%)				Yield (%)	Energy Recovery (%)
	Feed	Clean Coal	Mids	Tails	Feed	Clean Coal	Mids	Tails		
1	12.93	5.84	11.72	54.19	1.41	1.24	1.65	2.23	56.3	61.5
2	11.37	7.47	9.00	50.96	1.23	1.30	1.35	1.74	58.3	61.2
3	10.58	5.94	8.89	43.09	1.25	1.22	1.29	1.44	65.5	69.0
4	7.96	5.79	8.35	26.22	1.33	1.23	1.27	2.02	62.0	63.3
5	10.36	4.71	9.36	32.56	1.14	1.19	1.33	1.35	54.3	57.7
6	7.12	5.45	6.92	18.18	1.25	1.25	1.23	1.29	55.4	56.8
7	11.71	6.80	9.06	29.60	1.23	1.23	1.25	1.60	52.4	55.5
8	7.35	6.12	8.41	31.83	1.28	1.24	1.24	1.68	53.4	53.8
9	15.02	7.10	9.31	40.86	1.18	1.28	1.28	1.44	38.4	42.1

Glenwal Coal: For the Glenwal feed coal, the average ash reduction achieved by the FGX unit was from 25.57% to 8.56% while recovering 56% of the total feed weight (Table 12). This equates to an average ash rejection value of 80.28%. The average ash content in the tailings stream was 75.52% and values greater than 80% were realized from several tests. As a result, the mean heating value of the coal was upgraded from 10764 Btu/lb to 13470 Btu/lb.

Table 12. Separation performance data of the Glenwal coal sample; air-dried basis.

Test No.	Ash Content (%)				Total Sulfur (%)				Yield (%)	Energy Recovery (%)
	Feed	Clean Coal	Mids	Tails	Feed	Clean Coal	Mids	Tails		
13*	22.40	9.04	27.74	72.49	0.54	0.63	0.59	0.40	47.3	56.5
14	34.27	9.59	47.67	82.28	0.43	0.58	0.59	0.21	68.3	97.7
15	34.28	8.76	24.23	76.77	0.47	0.58	0.64	0.28	42.9	62.2
16	29.17	7.40	49.71	83.17	0.54	0.54	0.45	0.21	65.2	88.6
17	23.97	8.54	33.69	78.78	1.33	0.59	0.53	0.30	59.1	69.0
18	20.20	8.13	20.83	58.49	0.54	0.59	0.54	0.41	38.2	44.7
19	22.82	9.04	28.65	75.96	0.58	0.58	0.54	0.33	60.6	73.3
20	22.46	8.30	16.95	67.93	0.95	0.59	0.73	0.46	48.9	59.0
21	17.38	8.71	34.87	80.75	0.57	0.58	0.57	0.30	65.1	72.0

* The sample was wet when treated in the FGX

Pinnacle Coal: The Pinnacle ROM coal was processed first in the Accelerator and screened to provide sample for the FGX separator. The Accelerator is a technology that selectively break rock away from coal and produces a -2-inch product which was further treated by the FGX separator. The overall ash reduction achieved by the FGX unit for the Pinnacle tests was from 17.22% to 9.01% while recovering 55% of the total feed weight (Table 13). This equates to an average ash rejection value of 71%. The ash content in the tailings stream averaged 60.95% with values exceeding 70% achieved from several tests. The average heating value of the coal was upgraded from 11889 Btu/lb to 12988 Btu/lb. The optimum separation performance resulted in a clean coal product having 8.42% ash with an energy recovery of 76.6% (Test No. 22).

Table 13. Separation performance data achieved while treating Pinnacle coal sample; air-dried basis.

Test No.	Ash Content (%)				Total Sulfur (%)				Yield (%)	Energy Recovery (%)
	Feed	Clean Coal	Mids	Tails	Feed	Clean Coal	Mids	Tails		
22	16.30	8.42	26.80	74.40	0.46	0.48	0.44	0.30	69.0	76.6
23	16.83	9.17	11.00	54.99	0.46	0.48	0.49	0.38	50.2	60.6
24	22.08	9.19	21.04	70.65	0.43	0.50	0.45	0.30	68.0	68.5
25	19.03	9.26	18.60	71.89	0.47	0.49	0.46	0.34	62.2	70.2
26	16.03	9.18	14.26	51.53	0.47	0.47	0.47	0.38	43.2	46.7
27	17.45	9.44	12.01	58.36	0.49	0.49	0.48	0.39	52.4	55.4
28	15.52	8.73	11.63	49.30	0.48	0.48	0.50	0.38	39.6	43.2
29	14.49	8.72	12.37	56.46	0.49	0.49	0.48	0.33	56.1	59.8

<u>Westridge Coal:</u> The Westridge coal is characterized as having relatively high ash and sulfur contents. Over the entire test program, the ash reduction achieved by the FGX unit was from 20.56% to 7.53% while recovering 55.68% of the total feed weight (Table 14). The total sulfur content was decreased from 1.68% to 1.48%. This equates to ash and total sulfur rejection values of 78.51% and 50.74% on average, respectively. As a result, the average heating value of the coal was upgraded from 11677 Btu/lb to 13765 Btu/lb. The minimum product ash and total sulfur contents were 6.44% and 1.41%, respectively.

Table 14. Separation performance data achieved while treating Westridge high ash and sulfur coal sample; air-dried basis.

Test No.	Ash Content (%)				Total Sulfur (%)				Yield (%)	Energy Recovery (%)
	Feed	Clean Coal	Mids	Tails	Feed	Clean Coal	Mids	Tails		
31	27.71	7.01	15.20	48.36	1.72	1.50	1.69	2.37	26.7	34.8
32	18.27	7.77	17.26	58.38	1.69	1.48	1.73	2.06	47.5	54.2
33	19.40	7.44	16.03	55.59	1.63	1.51	1.57	2.08	44.0	50.9
34	17.83	8.19	28.51	72.06	1.70	1.57	1.93	2.10	71.5	81.2
35	23.32	7.60	26.17	72.26	1.72	1.42	1.80	2.25	67.0	82.5
36	18.93	6.44	16.19	57.51	1.60	1.49	1.63	2.34	48.8	56.6
37	21.77	8.10	39.87	73.41	1.68	1.49	1.98	2.09	73.6	88.2
38	17.27	7.65	22.78	67.06	1.66	1.41	1.84	2.45	66.5	74.6

Process Efficiency Evaluation

The efficiency of the separation achieved under the operating conditions that resulted in the ash reductions in Test 2 listed in Table 11 was evaluated by performing particle size-by-size washability analyses on representative samples from the feed and output streams. The data obtained from the middlings stream analysis were combined with those from the product streams to generate the partition curves in Figure 8. The significant finding is that 70% of the high density rock can be rejection while recovering greater than 5% of the 1.60 float material and 100% of the 1.5 float material.

The partition curves resulting from the middlings material being sent to the tailings stream indicates an overall relative separation density of around 1.87 with a corresponding probable error value of 0.24 (Figure 9). The total rock rejection was increased to about 85%. However, there was a significant amount of coal by-pass to the reject stream. The differences between the partition curves in Figures 4 and 5 are indicative of the amount of coal existing in the middlings stream, which further emphasizes the need to re-process the middlings stream to maximize recovery. As expected, separation density increases and process efficiency depreciates significantly with a reduction in particle size. In fact, the efficiency achieved on the -1/4-in material was poor; however, when the middlings stream is recovered to the product stream, 30% of the rock in the fine fraction can be rejected while recovering nearly 100% of the 1.6 float fraction (Figure 8).

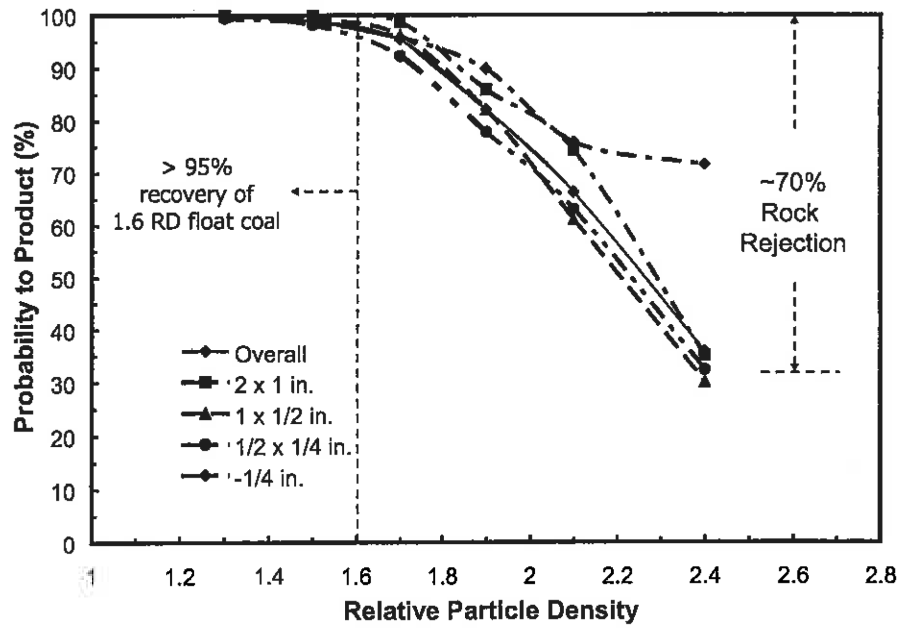


Figure 8. Particle size-by-size efficiency achieved by combining the product and middlings streams.

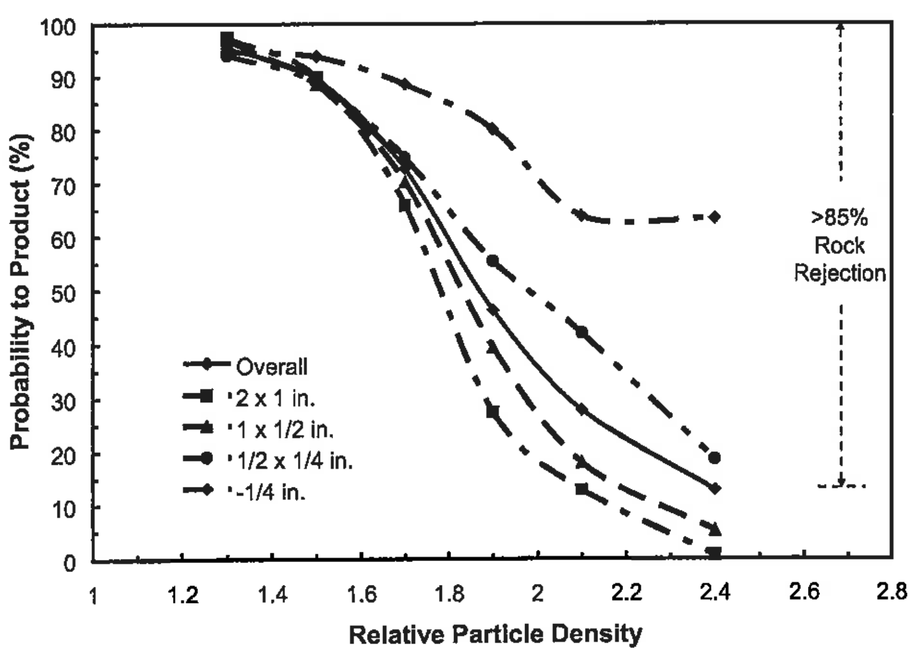


Figure 9. Particle size-by-size efficiency achieved by combining middlings and tailings streams.

Process Improvements

The washability analysis data of the middlings stream revealed the importance of recycling the material to the feed especially if the unit is being used to produce a clean coal concentrate as opposed to being a deshaler. As shown in Table 15, about 35% of the middling material was high quality 1.40 float coal. Combining the 1.4 float with the coal in the 1.40 x 1.60 density fraction would yield a product containing about 10% ash and representing nearly 46% of the feed mass. Thus, including the middling stream with the tailings material in an effort to produce a low ash product would not be an optimum economical option.

Table 15. Particle density-by-density weight and ash distribution in the middling material collected during a typical FGX test.

Relative Density Fraction	Weight (%)	Ash (%)
1.40 Float	35.33	6.40
1.40 x 1.60	10.52	23.66
1.60 x 1.80	7.98	37.54
1.80 x 2.00	7.06	53.45
2.00 x 2.20	9.4	72.20
2.20 Sink	29.8	88.87
Total	100.00	44.70

To estimate the effect of recycling the middlings stream to the feed stream, a linear analysis was performed based on the flow diagram in Figure 10. If F, P, M, L and T are the mass flow rates of their respective streams, the overall recovery R_o can be determined according to the following expression:

$$P = LR_1$$
$$T = L(1-R_1)(1-R_2) \quad [2]$$
$$R_o = \frac{P}{F} = \frac{P}{P+T} = \frac{LR_1}{LR_1 + L(1-R_1)(1-R_2)} = \frac{R_1}{R_1 + (1-R_1)(1-R_2)}$$

where R_1 and R_2 are the partition numbers associated with the probability of a particle in a density fraction to report to the product and middlings stream, respectively.

Using data from washability analyses of each process stream and the resulting partition numbers, the overall circuit recovery values for particles in each density fraction were determined using Eq. [2]. As shown in Figure 11, recycling the middlings stream is predicted to provide a significant improvement in separation efficiency as indicated by a decrease in the Ep value from 0.24 without recycle to 0.17, which equates to a 40% efficiency improvement. Middlings recycle also allows the rejection of about 95% of the high density rock while recovering nearly 100% of the 1.6 float material. As a result, middlings recycle will be incorporated into a future test program.

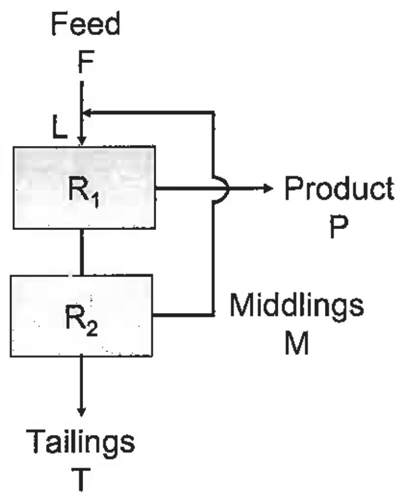


Figure 10. Flow diagram representing the recycle of the middlings stream to the feed stream of the FGX unit.

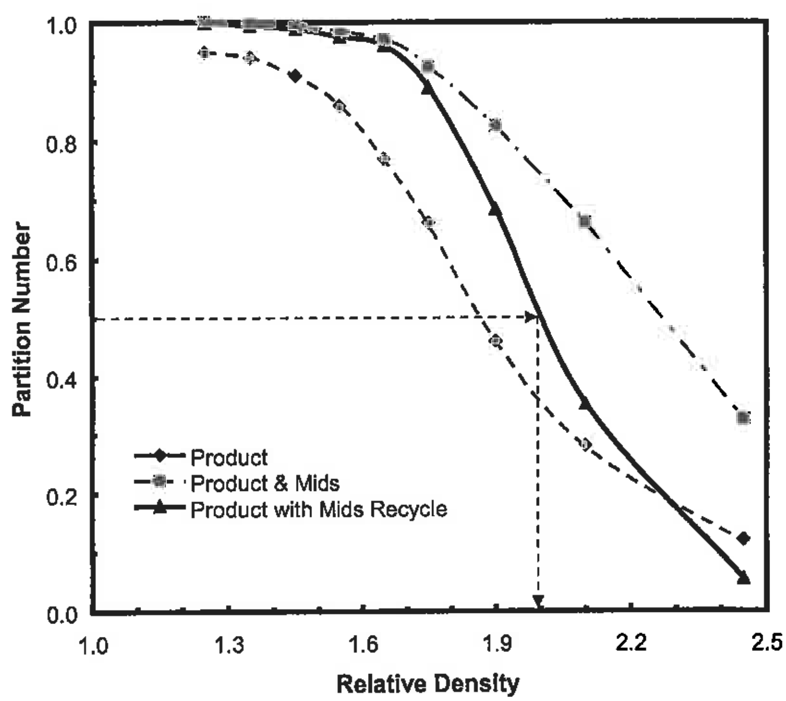


Figure 11. Predicted separation performance improvement provided by middlings recycle.

4.1.2 Powder River Basin (Wyoming) Coal

The processing of Powder River Basin coal typically involves simple crushing and loading. However, during the extraction process, out-of-seam rock contaminates some of the coal. The contaminated coal, typically referred to as 'rib' coal, is normally kept in the pit as fill material. At one coal operation, 'rib' coal amounts to 1 to 10 millions tons annually which represents a significant loss in potential revenue. Tests were performed to evaluate the feasibility of the FGX Separator to reject the out-of-seam rock and produce a marketable clean coal product.

The feed coal was screened to achieve a nominal 50 x 6.3mm particle size fraction to feed the dry separator. During the PRB parametric studies, the table products were sampled in 5 splits to provide mass and quality distributions of the material exiting the table. Product and reject streams were calculated as the combination of Splits 1 through 3 and Splits 4 through 6, respectively. Split 4 averaged about 47% ash from all 15 tests which indicates the presence of misplaced coal that could be recovered. Removing Split 4 from the tailings material resulted in a reject stream containing an average of 83.74% ash-bearing material. However, the goal of the study was to simply determine if a high quality coal could be produced from the current waste material and a corresponding estimate of yield.

The variation in the separation performances listed in Table 16 is indicative of the parametric values changes that were studied during the test program. The FGX Separator proved the ability to achieve a product quality sufficient for meeting market requirements. The ash content was reduced on average from 20.79% to 8.40% while recovering 59.1% of the current waste material. In some tests, the mass yield approached 90% while achieving product ash contents below 10%.

Table 16. FGX Separator Performances from the Treatment of PRB Sub-Bituminous coal.

Test No.	Feed Ash (%)	Product Ash (%)	Reject Ash (%)	Yield (%)	Energy Recovery (%)	Ash Reduction (%)
1	18.86	7.05	71.28	82.11	94.07	62.62
2	15.61	6.77	62.92	78.00	86.17	56.65
3	23.83	9.63	58.45	75.45	89.52	59.58
4	21.25	7.84	61.36	68.71	80.42	63.13
5	21.98	7.67	69.60	82.83	98.03	65.13
6	19.68	10.69	81.93	91.66	100.00	45.69
7	19.60	8.49	79.12	81.10	92.30	56.66
8	13.91	7.41	70.02	82.40	88.62	46.76
9	22.83	9.01	74.38	86.74	100.00	60.54
10	23.60	9.26	69.42	78.38	93.08	60.74
11	21.02	9.06	81.71	89.08	100.00	56.92
12	19.59	7.99	64.69	74.74	85.52	59.22
13	23.03	7.27	52.07	74.22	89.41	68.44
14	23.33	9.29	70.87	69.24	81.92	60.20
15	23.72	8.57	63.12	69.71	83.56	63.88
Average	20.79	8.40	68.73	78.96	90.84	59.08

4.1.3 Gulf Coast Lignite Coal (Texas)

The objectives of the test program performed on Gulf Coast lignite coal were to assess the feasibility of the FGX Separator to:

i. Reduce the total sulfur content of coal that is not marketable as a direct ship product;
ii. Decrease the mercury content;
iii. Improve the heating value.

The three goals are listed in the order of priority.

The feed coal was relatively low in ash content but high in total sulfur. A statistically-designed experimental program was performed to quantify the parametric efforts and to obtain optimum separation performance levels. The splitter positions were used in the test program to generate product, middling and tailing streams. The average separation performance achieved from the 17 test program provided a significant sulfur reduction from 1.91% to 1.23%. The sulfur reduction was due to the presence of large coal pyrite particles. Ash reduction was limited due to the low amounts of high density rock in the feed (i.e., 6.59% to 4.86% ash). As such, the improvement in the heating value was minimal (7710 BTU/lb to 7817 BTU/lb). Despite the low feed ash, the average mass yield to the product stream was 79%. The yield values were reflective of misplaced coal in the middlings stream which was combined with the tailings stream in the analysis. The splitter position is an operating parameter that can be changed to achieve the desired product grade while minimizing coal loss.

The most significant impact provided by the FGX Separator was the reduction in sulfur and mercury contents as shown in Table 17 and Figure 12. The average total sulfur reduction was 34.8%, which equates to an average SO_2 (lb/M-Btu) reduction of 35.8%. Although the feed sulfur content varied, the FGX Separator provided a consistent product SO_2 content of 3.2 lbs/M-Btu. It is generally known that the mercury content in coal is generally associated with the pyritic minerals. This well established observation is apparent in the Gulf Coast lignite coal as indicated by a large HG reduction of 54.4%. Although mercury content varied significantly throughout the testing program, a Hg content in the product of less than 10 lbs/T-Btu was generally achieved.

Table 17. Optimum separation performance summary from the treatment of the PRB coal.

Test	Product Ash %	Product Yield %	Ash Reduction %	Sulfur Reduction %	Mercury Reduction %
1	5.03	85.81	33.15	28.42	65.24
2	4.90	83.16	34.27	56.76	56.13
3	4.84	83.13	32.84	47.68	67.12
4	4.23	80.66	43.13	41.51	67.66

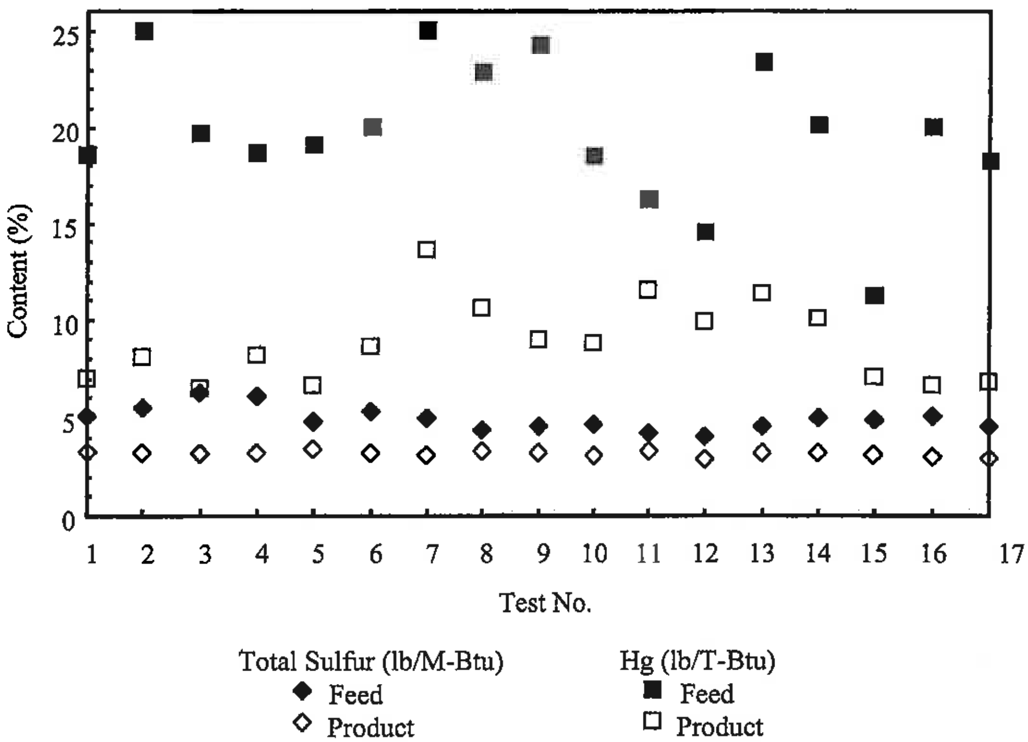


Figure 12. FGX separator sulfur and mercury reduction performances for Gulf Coast Lignite coal.

4.2 Eastern U.S. Coal Test Program

4.2.1 Central Appalachia Coal (Virginia)

The removal of rock from Central Appalachia run-of-mine coal prior to loading and hauling to a preparation plant has the potential of significantly improving energy efficiency and reducing operating costs. Tests were performed on a bituminous run-of mine coal at a mining operation located in Virginia. The goal was to maximize rock rejection while minimizing coal loss. Operating parameter values were varied in each test according to a statistically-designed test program. The feed ash content averaged 49.27%.

As shown in Table 18, the ash reductions achieved by the FGX Separator was significant with product ash content values less than 15% being realized in several tests. Given the program objectives, the FGX unit produced ash contents greater than 87% ash in the tailings stream in all tests indicating the ability to reject high-density rock without the loss of coal. Also, a few test conditions yielded ash contents in the middlings material exceeding 80% with greater than 50% mass yield to the product stream.

Under the conditions of Test No. 2, high-density rock removed from the run-of-mine material resulted in approximately 33.5% of the feed material being rejected. To assess the potential economical benefit, consider a 450 tph operation that operates 6000 hours annually and transports the run-of-mine coal 15 miles to a wet processing plant. The average transportation cost in the Central Appalachia region is $0.30/ton*mile. By rejecting 33.5% of the feed material, the annual reduction in operating cost is about $4 million.

Table 18. Separation performance achieved on a run-of-mine Virginia bituminous coal.

Test No.	Feed Ash (%)	Product Ash (%)	Middlings Ash (%)	Reject Ash (%)	Yield (%)
1	50.00	19.46	83.38	89.03	53.5
2	51.69	34.05	87.08	89.51	66.5
3	54.88	29.09	78.19	87.75	48.4
4	48.27	25.75	80.42	89.92	55.9
5	51.58	25.97	78.41	91.37	58.8
6	46.70	17.87	68.21	88.34	44.5
7	50.84	16.84	55.11	87.30	34.6
8	54.33	15.53	62.70	87.02	34.0
9	38.05	29.02	82.04	89.80	58.5
10	50.18	19.69	78.26	90.09	51.1
11	45.88	34.50	86.30	91.09	66.7
12	49.93	12.88	72.51	90.13	46.1
13	47.14	13.96	57.02	88.90	37.3
14	51.69	14.78	71.90	87.95	43.4
15	47.87	12.63	73.30	89.38	42.9
Aver.	49.27	21.47	74.32	89.17	49.5

4.2.2 Central Appalachia Coal (West Virginia)

From tests performed on a bituminous run-of-mine coal in West Virginia, an analysis of the reject material from the FGX unit indicated that the dry separator removed high-density material containing less than 1.32% coal that floats at a density of 1.6 RD (Table 19). The reject represented about 36% of the run-of-coal coal. Based on the typical operation, the reduction in operating cost is $4.37 million annually. The loss of coal resulting from rejecting the high-density material is 13,122 tons annually. Assuming a $40/ton coal value, the loss of coal has an annual value of $524,000. The operating cost of the FGX unit has been estimated at $0.50/ton which, for the example, equates to $1.35 million. Thus, the net profit gain from removing the high density rock is about $2.5 million annually. If the middling and tailing streams are combined, greater amounts of rock can be reject at a cost of more than double the amount of 1.6 RD float.

Table 19. FGX Reject Analysis from the Treatment of a West Virginia Bituminous Coal.

Test Number	Middlings & Reject Combined		Reject Only	
	% of Feed	% Float 1.6 RD	% of Feed	% Float 1.6 RD
1	50.7	3.71	35.9	1.51
2	49.5	2.82	33	0.90
3	55.1	3.72	36.6	1.32
4	52.4	2.73	36.4	0.78

4.2.3 Central Appalachia Coal (Kentucky)

A major coal producer in eastern Kentucky has large haul distances from their mine sites to the wet coal cleaning facilities. The use of a dry cleaning system at the mine site was evaluated to evaluate the feasibility of rejecting the high density rock at the mine site and avoid the transportation, processing and storage costs at the wet cleaning facility. The tests involved raw coal from 3 separate deep mine sources and seams. The Falcon raw coal from the Hagy seam is delivered by truck with a haul distance of 19 miles (one way). The Snapco raw coal from the Splashdam seam is delivered by truck with a haul distance of 18 miles. The Elkhorn No. 2 raw coal from the Alma seam is delivered by truck with a haul distance of 23 miles.

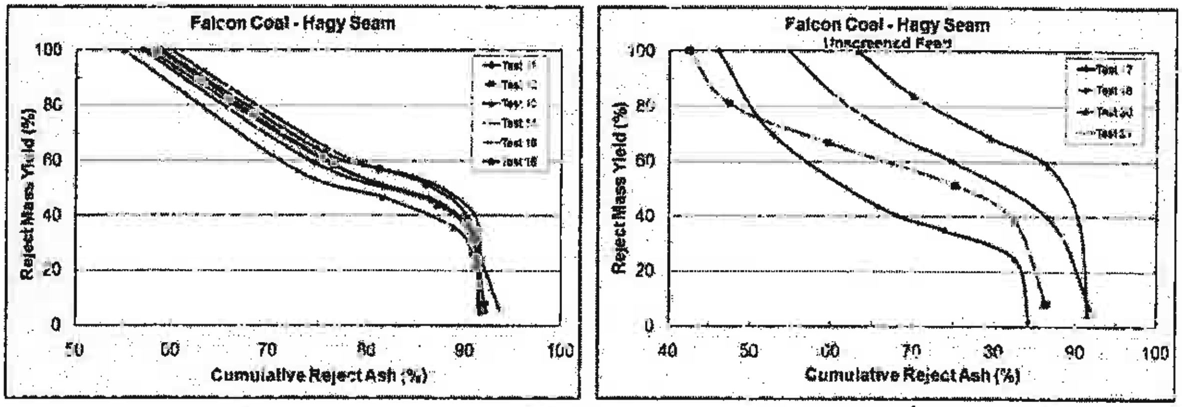
The separation performance results discussed in the sections to follow are based on cumulative yield and ash content reporting to the reject stream. The results for the tests with prescreened feed include a representative portion of the screen underflow (-6mm material) and baghouse dust combined with the first product sample split from the deck.

Falcon Coal – Hagy Seam

1. A total of 12 tests were performed on the Falcon raw coal under varying operating conditions including experiments with screened and unscreened feed. A vibrating screen with 6mm (¼ inch) aperture was used for prescreening purposes.

2. The separation performance results achieved on the prescreened coal over a range of operating parameter values were relatively consistent.

3. Based on the performance results, the optimal conditions appear to be represented by Test 14 where approximately 45% of the material can be rejected by applying the FGX technology and the rejected material will have an ash content of near 90%. The results are showed in Figure 13-a. The results also indicated that as much as 57.5% of the total 6mm (+¼ inch) Falcon raw coal can be rejected with an ash content of 89%.



a b

Figure 13. Separation performance for the Falcon Coal with the feed screened at 6mm (¼ inch) (a) and with unscreened feed (b).

4. The performance results achieved on the unscreened ROM raw coal was similar to those achieved on the prescreened material. As shown in Figure 13-b, a relatively sharp separation was obtained during Test 30 which indicates that 37.9% of the total feed can be rejected with the reject material having an ash content of 90.5%. Test 30 also represented the feed with the highest feed ash content (63.3%). Tests 17 and 18 were also tests with unscreened feed and had a larger portion of -¼ inch material, 56% and 52%, respectively. The higher fraction of fine material appears to degrade the separation performance.

5. Two tests were conducted with screened feed to evaluate the effect of increasing the mass feed flow rate for the unit with the Falcon raw coal. The performance results for Tests 40 and 41, shown in Figure 14, indicate that under the operating conditions for Test 40 approximately 20% of the total feed can be rejected with an ash content of 91% in the rejected material.

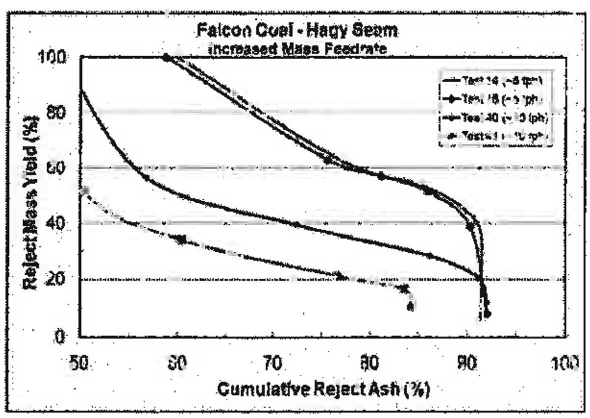


Figure 14. Separation performance for the Falcon Coal with increased mass feedrate screened at 6mm (¼ inch) compared with standard feedrate.

Snapco Coal – Splashdam Seam

1. A total of 5 tests were performed on the Snapco raw coal representing coal from the Splashdam seam, a high ash feed (>60%), under varying operating conditions including experiments with screened and unscreened feed. A vibrating screen with 6mm (¼ inch) aperture was used for prescreening purposes.

2. The separation performance results on the high ash feed indicated that the FGX technology can be used to reject about 25% of the total raw feed while producing a reject containing near 87% ash. All the tests for the screened feed produced similar results as shown in Figure 15.

3. Similar results, also shown in Figure 15, were achieved on the unscreened raw feed. The findings indicate that about 27% of the total Snapco ROM coal can be rejected with an ash content of about 87%.

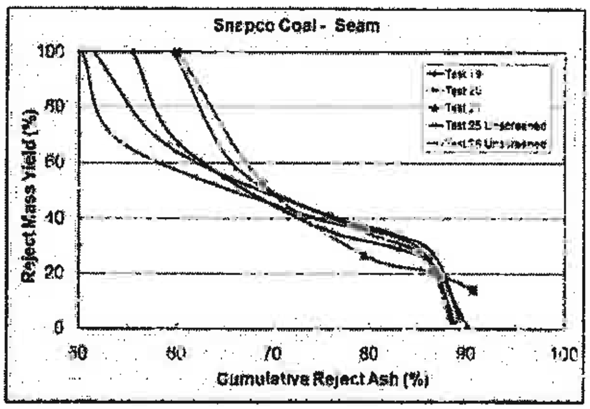
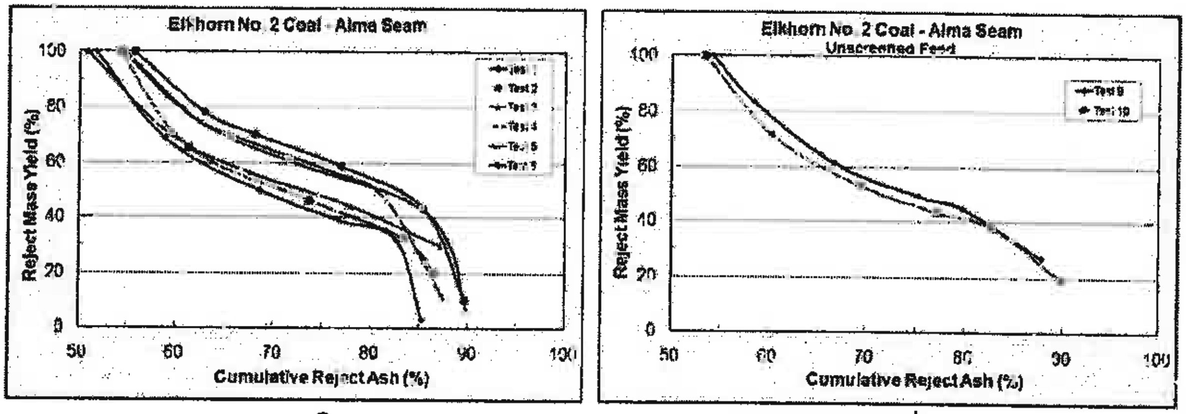


Figure 15. Separation performance for the Snapco Coal with the feed screened at 6mm (¼ inch) and with unscreened feed.

Elkhorn No. 2 Coal – Alma Seam

1. A total of 11 tests were performed on the Elkhorn No. 2 raw coal under varying operating conditions with prescreened and unscreened feeds. A vibrating screen with 6mm (¼ inch) aperture was used for prescreening the feed for the first 9 tests.

2. The results for Tests 1 – 6 are shown in Figure 16-a. The best ash rejection performance for the Elkhorn No. 2 coal was produced under slightly different operating conditions than for other coals tested. For Tests 5 and 6, the deck length-wise slope was set at 0.5 degrees less than that which has been found to be optimal for other coals. These tests indicate that approximately 36% of the nominal +6mm (+¼ inch) Elkhorn No. 2 feed can be rejected with an ash content of 88% for the rejected material.



a b

Figure 16. Separation performance for the Elkhorn No. 2 Coal with the feed screened at 6mm (¼ inch) (a) and with unscreened feed (b).

3. The results for the unscreened feed, shown in Figure 16-b, indicate a marginal potential for good separation. Although the results indicate that the high density material can be separated from the feed, the loss of coal to the reject increases significantly as the amount of reject increases.

4. Three additional tests were conducted using the Elkhorn No. 2 raw coal to determine the effect of feed mass flow rate on the separation performance. As shown in Figure 17, at a feed rate of approximately 50% more than the standard test conditions (Test 7), the separation performance appears to be similar to the best performance for the 6mm (+¼ inch) screened feed (Tests 5 and 6).

The results presented for the three coals are conservative in that the amount of coal loss is minimal given the relatively high reject ash contents. An additional amount of material could be rejected economically if the loss of a small amount of coal is balanced with the cost of transportation.

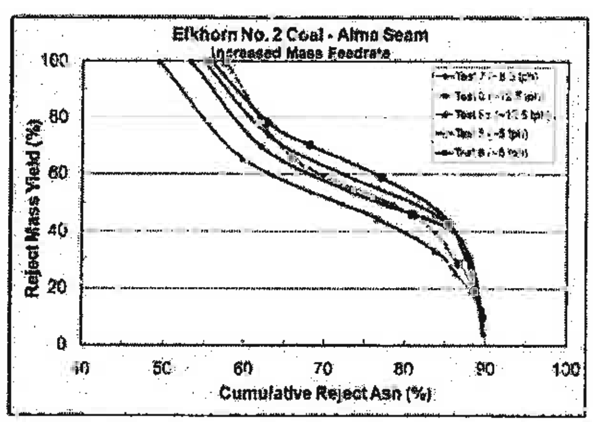


Figure 17. Separation performance for the Elkhorn No. 2 Coal with elevated feed mass flow rates.

4.3 Coarse Gob Coal

Coarse reject generated from previous preparation practices often contains a significant amount of high quality coal, especially at operations that existed prior to the 1980's. In the Central Appalachia region, decades of metallurgical quality coal was produced by attempting low density separations using the best available technology. The result was a high concentration of coal in the coarse reject that may contain moderate energy value as reflected by their relative particle densities (1.4 – 1.8 RD) and, in some cases, a significant amount of high energy coal as a result of process inefficiencies.

The 5 tph FGX unit was installed at an eastern Kentucky coarse reject site with the goal of achieving a clean bituminous coal product that could be marketed as steam coal. Objectives included maximizing quality while minimizing coal loss. A washability analysis of the +6mm (+1/4-in) fraction of a coarse reject sample collected at the site revealed that 45.3% of the material had a relative density less than 1.8 and a heating value of 10499 Btu/lb. The overall ash content and heating value of the material was 60.25% and 5408 Btu/lb, respectively.

A series of seven tests were performed over a range of operating parameter values to determine the optimum operating conditions. An important observation from the test results was that the longitudinal slope of the table must be maintained low when producing a high coal quality from feed coal containing a large amount of rock. Table 20 details the separation performance achieved along the length of the table under the optimum operating conditions. A separation between the 4th and 5th split resulted in a clean coal product containing nearly 10000 Btu/lb while recovering 44.5% of the total feed coal. Similar to the performance achieved on the previous coal sources, split 6 was comprised of mostly high density as indicated by an ash content of 81.53% and represents a significant amount of the total feed (i.e., 39.5%).

Table 20. FGX Separation Performance on Kentucky coarse gob.

Table Split Number	Incremental Values			Cumulative Values		
	Weight (%)	Ash (%)	Heating (btu/lb)	Weight (%)	Ash (%)	Heating (btu/lb)
1	12.19	31.32	10216	12.19	31.32	10216
2	17.91	34.83	9656	30.09	33.41	9883
3	10.96	33.28	9843	41.05	33.37	9872
4	3.44	29.57	10496	44.49	33.08	9920
5	16.01	49.24	7081	60.50	37.36	9169
6	39.50	81.53	1849	100.00	54.80	6278
	100.00	54.80	6278			

A second coarse reject material was evaluated at a site in Virginia. The feed contained 77.6% plus 6.3mm (1/4-in) material and 55.54% ash. The amount of 1.8 RD float material in the plus 6.3mm (¼-in) fraction of the feed was 46.4%. A total of three tests were performed and Splits 5 and 6 were combined to obtain an appropriate amount of sample to analyze. The FGX Separator provided a significant upgrading as indicated by a decrease in the ash content from 55.54% to 31.84% when combining Splits 1 and 2 thereby resulting in a cumulative mass yield of 44.4% (Table 21). However, it is apparent that improvement in ash reduction is possible based on the amount of 1.8 RD sink in the two splits. The amount of 1.8 RD float material in Split 3 indicates potential to recover a significantly greater amount of coal by recycling the stream to the feed of the separator. The excellent deshaling capability of the FGX unit is demonstrated by the combined ash content of 84.40% in Splits 4 and 5 which represents 37.79% of the total feed.

Table 21. FGX separation performance on Virginia coarse gob.

Table Split Number	Incremental Values			Cumulative Values	
	Weight (%)	Ash (%)	% 1.8 RD Float	Weight (%)	Ash (%)
1	21.96	29.89	84.63	21.96	29.89
2	22.43	33.74	77.66	44.39	31.84
3	17.82	53.38	49.09	62.21	38.01
4	17.26	80.32	8.32	79.47	47.20
5	20.53	87.83	1.02	100.00	55.54
Total	100.00	55.54	46.40		

Based on washability data and the results presented in Table 20, it is feasible that the operating set points of the FGX unit could be altered to produce clean coal with a near 20% ash content or a second FGX Separator could be employed as a cleaner unit for the same purpose. An alternative scenario is to use the dry cleaner to reject as much rock as possible and transport the product to a wet cleaning plant to achieve the desired product grade.

5.0 TECHNICAL SUMMARY AND CONCLUSIONS

The FGX Separator provides a dry, density-based separation that utilizes the combined separating principles of an autogenous fluidized bed and a table concentrator. The dry cleaning process has been evaluated at several mining operations across the U.S. for the treatment of run-of-mine coal and coarse coal reject of all ranks. The objectives of the test programs at each site varied and included 1) the production of clean coal having qualities that meet contract specifications and 2) maximization of the amount of high-density rock rejected prior to transportation and processing. A 5 tph pilot-scale unit of the FGX Separator was installed and a detailed parametric study performed at each site to ensure that optimum performances were realized for each coal.

The FGX Separator provides a relatively efficient separation at high separation density values of around 1.8 RD to 2.2 RD. The typical probable error (E_p) value achieved was 0.25. However, if the middling stream is recycled to the feed stream, the process efficiency can be significantly improved as indicated by a reduction in the E_p value to 0.17. Partition curves clearly indicate that the FGX unit has the ability to reject at least 70% of the high density rock in a run-of-mine coal without loss of coal and the need to recycle the middlings stream. The impact was realized when treating Central Appalachia bituminous coal that contained significant amounts of high-density material. From run-of-mine coal, the FGX Separator removed 36% of the total which contained only about 1.3% coal that floated at 1.60 RD. Coarse reject material that was generated from decades of wet preparation plant production was also affectively treated to recover coal with a heating value around 10000 Btu/lb.

For coals containing little or no material having a density between 1.6 RD and 2.0 RD, the FGX Separator has the ability to produce a product that meets utility contract specifications. For sub-bituminous coal from the Powder River Basin, the ash content was reduced from about 20.79% to 8.40% on average over a test program of 15 tests which involved systematic variations in the critical operating values. Similar results were obtained for bituminous run-of-mine coal at a mining operation in Utah. The dry air table separator also reduced the total sulfur and mercury contents of Gulf Coast lignite by 35% and 54%, respectively.

The results from the Gulf Coast lignite tests resulted in the installation of the first FGX coal cleaning facility in the U.S.. The full-scale facility processes the +6mm (+1/4-inch) particle size fraction. Approximately 250 tph of material are processed across two table decks with the primary objectives of maximizing total sulfur and mercury rejections while recovering greater than 92% of the energy value in the feed coal.

Specific conclusions generated from the project include:

1. The FGX dry density-based separator is ideal for achieving high density separations in situations where the objective is to maximize rock rejection while avoiding the loss of coal. The density cut point achievable is 1.8 RD or greater.

2. The separation yields a middlings stream that is comprised of a mixture of low-density coal and high-density rock. The amount of material in the middlings stream is dependent

on the operating parameter values and feed coal characteristics (particle size and density distributions as well as particle shape.

3. Visual observations revealed that particle shape has an impact on the separation performance. Reject particles that are flat or saucer shaped tended to report to the clean coal stream.

4. If little or no material exists in the 1.6 x 2.0 specific gravity fractions in the feed, the FGX separator can provide a high quality product that may meet contractual end-user requirements.

5. A percentage of fine, high-density particle by-pass to the product stream occurred and is expected since the fluidized particle bed is comprised of the high ash material and there is no method of preventing the material from overflowing. The amount of fine, high density by-pass was measured to be around 20% in a process efficiency evaluation conducted in this study.

6. The throughput capacity appears to be relatively high at around 5 – 10 tph/m^2.

7. Longitudinal slope and table frequency appear to be the critical operating parameters that control both coal recovery and product grade. Longitudinal slope was manipulated with respect to the amount of high-density reject in the feed. When the feed contained a large amount of high-density material (i.e., greater than 50% ash-bearing material), a low slope of 0.5^O was used which provided less resistance for the reject when moving toward the reject discharge end of the table. A slope of 1.5^O provides greater resistance to movement which holds back the reject discharge rate and allows a fluidized bed of sufficient depth to provide optimum coal recovery. Adjusting table frequency has similar effects on performance.

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7.0 PRODUCTS PRODUCED OR TECHNOLOGY TRANSFER ACTIVITIES

7.1 Publications

i. Honaker, R. Q., Luttrell, G. H., Bratton, R and. Patil, D., "Improving Mine Profitability Using Dry Deshaling Technologies," *Proceedings*, 31st International Conference on Coal Utilization & Fuel Systems, Clearwater, Florida, Paper No. 49, May 21-25, 2006.
ii. Honaker, R. Q., Luttrell, G. H. and Lineberry, G. T., "Improved Coal Mining Economics Using Near-Face Deshaling, *Minerals and Metallurgical Processing Journal*, Vol. 23. No. 2, pp. 73 – 79, 2006.
iii. Honaker, R. Q., Luttrell, G. H., Bratton, R., Saracoglu, M, Thompson E., and Richardson V., "Dry Coal Cleaning Using The FGX Separator," *Proceedings*, 24th International Coal Preparation Conference, Lexington, Kentucky, pp. 19 – 36, April 30 – May 3, 2007, pp. 61 - 76.
iv. Honaker, R. Q., "Dry Coal Cleaning Technologies for India Coal," Workshop on Coal Beneficiation and Utilization of Rejects: Initiatives, Policies & Best Practices, Ranchi, India, August 22 – 24, 2007.
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7.2 Networks or Collaborations Fostered

During the project, several companies have expressed interest in evaluating the technology and concept through in-field tests or process performance projections. The companies outside the project team include:

1. Consol Energy;
2. National Coal;
3. Andalex;
4. American Electric Power;
5. Arch Coal;
6. Coaltech;
7. Tampa Electric Coal (TECO);
8. Alpha Natural Resources;
9. Luminant Mining.

The collaboration with Luminant Mining led to a commercial installation of a 600 tph dry coal cleaning facility near Oak Hill, Texas. The FGX tables treat the +6mm particle size fraction at a throughput capacity of 250 tph. The main objective of the facility is to reduce the total sulfur and mercury contents. The operation was brought on-line around June 2008.

Presentations have been provided to several companies and organizations including the East Kentucky Coal Preparation Society (February 2006) and the Annual Society for Mining, Metallurgy and Exploration meeting in St. Louis (March 2006).

The research findings have also been presented to coal operators and plant designers in the countries of Brazil (September 2007), South Africa (September 2007) and India (August 2007). The conversations and subsequent testing on Brazilian coals resulted in a commercial installation of the FGX separator by a U.S. manufacturer. The promising results for the project also resulted in a funded project to investigate the potential for cleaning India coals. The project is being sponsored by the U.S. Department of State.

7.3 Inventions/Patent Applications

There were no invention/patent applications filed as a result of work performed in this project.